MEMPHIS AIRPORT AREA
LAND USE STUDY
FINAL REPORT

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Appendices:

EXECUTIVE SUMMARY

The growth of the Memphis International Airport has been in response to the regional community's growth in jobs and overall economic development. The airport has had a positive economic impact on the community and is the largest employer in Tennessee. The airport's growth has not come without negative impacts and has created the need to provide for the orderly control of this growth. Five local governments of Tennessee and Mississippi have accepted this responsibility by preparing the Memphis Airport Area Land Use Plan.

Memphis and Shelby County, Tennessee, and Southaven, Horn Lake, and DeSoto County, Mississippi, have cooperated in a regional land use study to determine the future of the area surrounding the airport. The land use plan recommends a desirable arrangement of land uses, along with major streets, highways, and community facilities (fire stations, schools, etc.) that will be required to serve the community. The study was undertaken to address three conditions impacting the communities surrounding Memphis International Airport.

- Impacts of airport growth; i.e., noise and land use changes
- Unplanned growth, resulting in residences in high-noise zones and commercial industrial uses encroaching into neighborhoods
- Aging structures and the deterioration of older neighborhoods

The study team has collected data, analyzed problems, evaluated alternative solutions, and selected a final plan with the help of community input through a number of neighborhood meetings.

The land use plan consists of goals and objectives to be achieved, guidelines to help shape public and private actions, recommended amendments to zoning and building codes, coordination of capital budgets, and enactment of a buyout redevelopment program. This summary describes highlights of the recommended plan.

GOALS AND OBJECTIVES

The following issues were discussed as part of this study: residential, commercial, and industrial land use locations; noise pollution and factors affecting quality of life in the community, including substandard housing conditions, neighborhood livability, community facilities, urban design, and architecturally and historically significant places; environmental factors, including flooding and floodplain development, urban stormwater runoff, and soil erosion; performance of the transportation system; and implementation activities.

RECOMMENDATIONS

The Land Use Plan Map depicts the general distribution of activities by use categories. The pattern represents the means of supporting the established urban areas, as well as accommodating new development. Recommended land use is also shown in the buyout areas, which are to be redeveloped by private or public means. Purchase of residential properties in the buyout area by the Memphis-Shelby County Airport Authority will remove some homes from high-noise locations and permit reuse of the land for noise-tolerant activities.

TENNESSEE LAND USE

A balanced approach of maintaining the established neighborhoods and providing opportunities for employment is recommended.

Neighborhoods surrounding the buyout redevelopment areas are generally proposed to be maintained in their current use patterns. Community stabilization activities recommended in the plan are offered as a device to return the high quality of life to the Whitehaven, Northern Charjean, and Oakhaven neighborhoods.

The large employment area located generally between Winchester and Interstate 240 will be reinforced, and a future office/business park complex is planned to be developed to the south, southeast, and east of the airport as well. Through exercise of the buyout program by the Airport Authority, the cleared residential areas will be replaced by a variety of new employment land uses.

The Airways Road corridor will be developed as a high-quality office park area along the western edge of the airport, extending the land development theme initiated by the Nonconnah Corporate Center and the Federal Express office complex.

The Charjean buyout area is recommended to be used for similar office/business activities, with additional redevelopment activity proposed to connect the core buyout area with Airways Road and Interstate 240.

The Oakhaven area is recommended to remain as a residential neighborhood. Houses will be purchased between Hurricane Creek and Nancy Road to accommodate airport expansion. Houses on both sides of Nancy Road will be purchased to allow for the relocation of Swinnea Road. A buffer strip and berm is planned to shield the neighborhood from the airport uses and road. No additional buyouts are planned or anticipated east of the new Swinnea Road.

MISSISSIPPI LAND USE

The balancing of major land development activities expected over the next 20 years with the current pattern established in the Horn lake and Southaven communities is indicated by the following land use relationships.

- Coordination of aircraft flight paths, where feasible, over commercial and industrial areas that are less sensitive to noise
- Continued residential development east of Tchulahoma Road
- Growth of commercial development around the hospital and mall site, as well as along Interstate 55

The Greenbrook buyout area has been recommended for public use development as part of the strategy to stabilize this established single-family neighborhood.

COMMERCIAL CENTERS

Retail shopping and services should be available to all parts of the community. Neighborhood, community, regional, and urban level centers will include shopping and nonretail services, provide sites for major community facilities, and function as employment centers in the community. The centers are planned to be served by

appropriate transportation routes and easily accessible to adjoining residential neighborhoods.

BUYOUT REDEVELOPMENT

Guidelines have been defined for the buyout areas to guide their successful redevelopment. The package of guidelines and redevelopment plans prepared for each buyout area considers ways to redevelop the property for productive long-term land uses. The type of land uses must be consistent with the quantity of land, its proximity to potential long-term markets, and its level of accessibility and visibility.

The means of protecting existing neighborhoods adjoining buyout areas from disruption caused by the new land uses have been given equal importance in the plan preparation. These guidelines recommend reorganizing the local transportation network, including the closing of local streets in some situations, the recommending of construction of significant buffer zones, and the installation of design guidelines on redevelopment parcels.

Guidelines have also been prepared for the Oakhaven neighborhood located along the eastern edge of the airport property. A portion of the Oakhaven neighborhood is being purchased for relocation of Swinnea Road and future airport development.

The land use plan recognizes the unique needs of residential areas located adjacent to the buyout/redevelopment areas. By acknowledging the destabilizing forces at work in the buyout areas due to removal of single-family homes, the plan recommends techniques to return the stable quality of life to the remaining residential areas. Such techniques as the street-closure concept and buffer concept are illustrated in this report.

AIRCRAFT NOISE

The analysis of aircraft noise indicated the need for guidelines aimed at coordinating land use and noise patterns. The following items summarize recommended noise control measures.

- Construction of new buildings: Use building code provisions to specify adequate sound insulation for different types of buildings. Requirements are based on L_{dn} contour.

  Before implementation, examine cost implications for construction. See Appendix B.

- Location of new residential buildings: Restrict residential development using noise contours. Recommended method is to prohibit new residential development within the 65 L_{dn} contour. Note that the contour should not include the noise produced by nighttime cargo operations.

  Before implementation, examine current and future contours to determine the extent of possible prohibition. Discuss how future contour revisions will be coordinated between the airport authority and the affected jurisdictions.

- Any development along Airways Road or New Swinnea Road: Noise barriers can help reduce noise levels in areas immediately east or west of the airport. The barriers could be on airport property, in the road rights-of-way, or on private property. Examine any potential development for possible noise barrier effects (consider elevated roadways, buffer zones between airport and road or between road and houses, buildings that could serve as noise barriers, and requirements for developers to build barriers).

Before implementation, identify responsibilities for various locations--Airport Authority, highway or engineering department, redevelopment authority--so that barriers will be considered during any future development. Discuss with responsible authorities the desirability of having barriers for the various locations predesigned so that the airport, highway department, or developer will not have to individually fund the necessary design effort.

Recent noise legislation was passed by Congress on October 27, 1990, that is designed to improve noise conditions around airports. The two main issues addressed in the bill are the Passenger Facility Charge (PFC) and the phaseout of Stage II aircraft by the end of 1999. The PFC is a fee imposed on enplaning, originating, and connecting passengers. The revenue from this charge must be used at that airport for expansion and noise compatibility projects. These actions are expected to assist in reducing noise impact in the airport area.

ROAD IMPROVEMENTS

The street and highway system serving the study area has been analyzed to identify existing problems, as well as future deficiencies that may be aggravated by future land use development patterns. In coordination with the established transportation planning program in the community, the land use plan recommends additional improvements in the major highway system. In Tennessee, these improvements will be recommended as part of the Major Road Plan update.

In Mississippi, guidelines for State Line Road, Goodman Road, extension of Rasco Road, U.S. Highway 51, and Horn Lake Road have been made.

PUBLIC FACILITIES

Existing services and facilities are adequate within fully developed portions of Memphis and Shelby County. The sewer treatment plant has the capacity to serve near future development as sewer and water lines can be extended to developing areas. Excellent fire, police, and school services are provided within the City of Memphis. However, county areas south and east of the airport will need additional facilities, which are recommended in this report.

Services and facilities in Horn Lake and Southaven are currently at very high levels and are scheduled for expansion as these communities grow geographically. Water and sewer lines can be extended in most areas, and sewer treatment plant capacity is adequate for the near future.

IMPLEMENTATION STRATEGY

Implementation of the land use plan consists of a series of activities combined into a long-term strategy. Actions include zoning amendments, building code amendments, and a buyout redevelopment program.

ZONING AMENDMENTS

A significant element in the zoning strategy includes the definition and adoption of two new zoning districts. The "planned office park" and "planned business park" districts are intended to allow a range of office and business park uses and will require buffers, landscaping, and other design requirements. Procedures proposed for the application of

the two districts will require property owners to receive approval of specific development plans prior to the approval of uses. The development plan approval process is intended to insure the long-term compatibility of office and business park activities with neighboring properties.

The second zoning action will be the comprehensive rezoning of property to districts that permit uses more compatible with the land use plan.

Comprehensive rezoning will be required for property in the buyout areas, as well as the emerging office/business park area proposed for land south and east of the airport.

BUILDING CODE

Proposed amendments to the building codes in the five governmental jurisdictions are intended to increase the protection of future users of buildings from disruptive noise levels. The building code amendments will be structured to match the level of noise mitigation construction requirements to the level of aircraft noise. The "user friendly" guidelines will be suitable for interpretation by property owners, as well as trained building designers.

BUYOUT REDEVELOPMENT PROGRAM

The objective of this program is to accomplish redevelopment of the buyout areas while buffering and stabilizing the adjacent residential neighborhoods from the new uses.

The program outlines a means of addressing in a comprehensive manner the redevelopment of the buyout areas.

Included in the process is the creation of a redevelopment agency in the Tennessee jurisdictions that will oversee redevelopment of the buyout areas. Tools available to the redevelopment process may include:

- The acquisition of additional property that hinders high-quality development
- The sale of cleared land to private developers
- The monitoring and enforcement of explicit development plans for the protection of adjoining residential areas
- Investigation of ways to apply noise insulation and noise barrier construction improvements in existing residential neighborhoods.

The items covered in this Executive Summary are discussed in more detail in the following sections. Additional information is also available in the Inventory and Analysis Report and the Alternative Plans Report, which are previous volumes in the Memphis Area Land Use Plan process.

INTRODUCTION

Five local governments--**Memphis, Shelby County, Southaven, Horn Lake, and DeSoto County**--havelaunched a regional planning program to address land use issues in the area surrounding the Memphis International Airport. With financial assistance from the Memphis-Shelby County Airport Authority, the five governments are directing this study, conducted by a team of consultants led by Barge, Waggoner, Sumner and Cannon, a local planning and engineering firm.

The study was designed to have citizen input during all phases of the planning process. The project was started with a series of workshops set up to allow citizens to discuss the project with local staff personnel and consultants. These workshops resulted in the identification of issues, goals, opportunities, and problems which were used to guide the study. Public meetings were held in each phase of the study, and additional neighborhood meetings were held to discuss the development and selection of alternatives for the plan. Meetings were also held with elected and appointed officials. Three newsletters were produced during the process and each was mailed to approximately 15,000 citizens in the study area.

The research and analysis phase and the development of an alternative phase of the planning program have been completed. Phase III, the development of the final plan, is described in this report. The final plan is composed of elements from the three alternative plans plus new elements based on public comment and community review. The key elements that have been examined as part of the plan development process include:

Market/Land Use Implications. How does the plan accommodate expected growth? What impact will growth have on the downtown area and other major areas?

Transportation Analysis. How does the plan accommodate existing street/highway systems and planned improvements? The location of employment and residential areas could significantly alter traffic flow patterns.

Community Facility Impacts. How does the plan provide for existing and planned community facilities in order to meet the needs of future residents and employees in the study area?

Sewage and Drainage Systems. How does the plan impact existing and proposed community sewage and drainage systems?

Noise Impact Analysis. How will the plan reduce problems caused by aircraft noise?

Land Use Control Programs. What action is required to guide construction of the land use plan over the next 20 years?

BACKGROUND

The study area encompasses nearly 90 square miles. (See Figure 1 in the "Land Use" section of this report.) A portion of the study area is in Mississippi and includes the fast-growing municipalities of Horn Lake and Southaven, as well as an area of unincorporated DeSoto County. The remainder of the study area is in Tennessee and includes older, established neighborhoods in Memphis, as well as more sparsely developed portions of unincorporated Shelby County. The study covers an expansive geographic area with many unrelated and diverse uses that have little in common other than aircraft noise. It is the common denominator of aircraft noise that has led to this planning program.

Based on projected noise levels, all five jurisdictions are affected, or potentially affected, by aircraft noise levels of 60 L_{dn} (Day Night Sound Level) or above. The airport lies within the City of Memphis, and neighborhoods to the east, west, and north experience problems caused by aircraft noise. The City of Southaven, located two miles due south of the airport, is aligned with the principal runways. Noise contours of the 65, 70, and 75-L_{dn} level occur in both Memphis and Southaven and extend beyond the corporate limits to include extensive unincorporated areas in Shelby and DeSoto Counties. The present corporate limits of the City of Horn Lake do not include any area within the projected 65-L_{dn} contour.

The Airport Authority has invited the five units of government to participate in a joint land use planning program funded by the Authority. The planning program is focusing on two major objectives in pursuit of the goal of enhanced noise compatibility between the airport and its neighbors. A primary objective of the program is to avoid future growth of noise-sensitive land uses in the vicinity of the Memphis International Airport.

Another equally important objective is to assist in implementing the Memphis Airport noise compatibility program, which contains recommended noise abatement actions that focus upon airport and aircraft operations. This program also includes recommended noise mitigation actions that focus upon the elimination and prevention of incompatible uses of property in noise-impacted areas surrounding the airport. The goal of this study is to carry out or facilitate the recommended noise mitigation actions that require the adoption of plans, policies, and ordinances by units of local government. The Airport Authority has already begun a major noise mitigation initiative included in the noise compatibility program. It has made a commitment to acquire all property within the 75-L_{dn} contour that is used in a manner considered incompatible with such a noise level. Acquisition of affected property is projected to cost $120 million. At this date, a total of $55 million has been amassed for this effort. Twenty million dollars has been raised through a City of Memphis general obligation bond issue, to be repaid from airport revenues. The balance of $100 million in acquisition funds is expected to come from state and federal sources, $44 million of which is in hand.

PLANNING PROCESS

The land use program being undertaken by communities surrounding the airport is divided into four primary phases: 1) data collection and analysis; 2) alternative plans; 3) final plan; and 4) implementation actions.

The first phase of the study was completed at the end of 1989, and public meetings were held to review results of the data collection and analysis stage. The second phase, the definition and evaluation of alternative plans, was completed in early 1990.

This phase of the study, preparation of the final plan to be recommended to the five local governments in the study area, defines a plan to help resolve issues identified in the alternative plan evaluation report and to go through a process of fine tuning the plan for adoption by each local government.

The final phase will investigate ways for local governments to begin implementing the plan through amendments to their respective zoning ordinances and zoning maps and revisions of the building codes. Other implementation actions may also be defined.

The primary objectives of the land use plan to be adopted by the Cities of Memphis, Southaven, and Horn Lake, and the Counties of Shelby and DeSoto are:

- Define a structure for land uses that will be accomplished over the next 10 to 20 years--a long-term planning horizon.

- Protect, preserve, and enhance existing land use assets in the communities, such as viable residential neighborhoods and places of employment, and move toward solutions of existing problems.

- Guide the location and intensity of development of the various new land uses in the communities to reinforce the function of existing areas, permit investment of private capital, and develop more livable communities.

- Provide public policy planning foundation to aid local governments in administering zoning regulations and related land use control ordinances.

- Provide a framework to coordinate plans of other public entities for investment of public funds in roadways, schools, parks, and other public facilities.

- Coordinate land use decisions with the noise compatibility program being undertaken by the Airport Authority to eliminate existing, and help avoid creating future noise/land use problems.

GOAL FRAMEWORK

A land use plan is a public document composed of goals and policies that set out guidelines to be used in the future development of the community. The plan is a legal document that influences public and private decisions because its recommendations are supported by both sectors. The plan contains recommendations that strengthen some of the local governmental unit's assets and move toward solving some of the problems faced by the community.

The general guideposts defined by the plan to mark positive accomplishments in the community are contained in goal statements. Goal statements describe positive elements that the plan will achieve while solving some of the city's problems, which are defined in issue statements.

Planning for jurisdictions in the airport study area--the City of Memphis, Shelby County, City of Southaven, City of Horn Lake, and DeSoto County--is a continuing process that builds on previous planning decisions. Goals defined for previous plans and adopted by the jurisdictions may describe best the continuing aspirations of the community. Likewise, issues defined in previous planning studies may also continue to describe problems to be faced by the community. Because contemporary conditions dictate the definition of new issues, additional goals to guide community actions are required in this plan. This section of the plan identifies the current understanding of issues faced by the community and identifies goals to guide future action.

The following goal statements have been defined to help clarify the direction of change in the community and to help interpret and resolve new issues that may be identified in subsequent years. The goals are divided by topical areas to help pinpoint their application.

LAND USE PATTERN

Issue: Characteristics of the land use pattern, such as strip commercial development and residential sprawl, create a costly and inefficient urban environment.

In residential neighborhoods located immediately adjacent to buyout areas, should conversion by private property owners to nonresidential uses be encouraged? Should self-contained neighborhoods, such as Oakhaven and Greenbrook, be encouraged to maintain their residential character, or should owners be encouraged to convert to nonresidential uses?

Goal: (General) Promote an urban pattern that provides for the safe and efficient movement of people and goods, reduces conflicts among land uses, and protects the local natural environment.

Provide areas for future land use on the basis of projected needs, and form a well-balanced economic and social community in terms of long-range development so that land resources will not be wasted or misused in the future.

Provide for the orderly growth and future development which will enhance the appearance and living environment and maintain a spirit of unity in the community.

Eliminate strip commercial areas by encouraging the development of activity centers which incorporate commercial and office uses in a coordinated arrangement with internal traffic flow.

Provide a stable urban environment where owners of property located adjacent to the buyout areas can achieve maximum use of their land.

Goal: (Residential Uses) Encourage diversity and quality of residential development through varied densities related to public, semipublic, and private facilities and services, and through application of appropriate controls and regulations for maintaining standards of residential development consistent with county objectives.

Goal: (Commercial and Industrial Uses) Encourage the expansion and strengthening of existing commercial areas and the development of new, strong, identifiable business areas in locations which have good vehicular access from the surrounding residential areas and from the larger countywide and regional market areas, but at locations which would not result in undesirable encroachment of the commercial areas into the residential district.

Promote development of a central commercial area to serve the community located in proximity to residential areas and the community's transportation system.

Encourage continued expansion and development of industrial land uses in areas offering maximum potential for development, but compatible with surrounding land uses and transportation facilities.

LAND USE LIFE CYCLE

Issue: All land developed with urban uses enters into a life cycle that is influenced by social, economic, and physical forces, some under the control of the property owner and others influenced by neighbors, the community, government, and society in general. Most land uses make productive contributions to the community's life, while others have outlived their period of useful contribution. The issue is to discern where individual properties and neighborhoods are on the life cycle and to match public and private actions accordingly.

Goal: Encourage long-term use of private and public property through cost-effective maintenance and improvement actions.

Promote the retention of historic structures and areas in productive use, continuing to serve the community.

Encourage the recycling of building and property shells to house a new generation of land uses.

Encourage the private sector to redevelop economically, physically, or socially obsolete properties with uses consistent with the land use plan.

Recognize that the public resources available to address publicly sponsored redevelopment are limited and should be used primarily as a last resort in solving urban change issues.

NOISE POLLUTION

Issue: Noise levels at certain locations often exceed federally set guidelines, create health hazards, and reduce the quality of the living environment. Sources of excessive noise are railroads and switchyards, major thoroughfares, airports, and some industries.

The present land use planning effort for the 90-square-mile area surrounding the Memphis Airport has been undertaken in part to solve community disruptions caused by high aircraft-generated noise levels. The documented noise impacts have resulted in the Airport Authority's initiation of a buyout program to acquire single-family houses located in areas exposed to noise levels equal to or greater than 75 L_{dn}. Land thus acquired by the Authority must be used for compatible purposes. In addition to determining use for the high-noise-impacted property, the following additional related issues exist:

a. What schedule should be followed in utilizing acquired land? How can its use by private owners contribute to a stable, growing community?

b. How should vacant land owned by the private sector, both inside and adjacent to the high-noise-impacted area, be zoned? What community needs can be met?

c. How can existing residential areas located adjacent to the high-noise-impacted property be protected over the long term from negative influences resulting from the noise level?

d. How can building code requirements adequately address noise control design standards for new structures located on property in the 65- to 75-L_{dn} area without substantially increasing the cost of construction? Can building code noise-reduction requirements be required for new structures located in the 60- to 65-L_{dn} area as a means of transitioning construction cost from the unprotected perimeter of the airport area where the L_{dn} noise level is below 60 to units located in areas between the 65 to 75 L^{dn} levels?

e. Will private subdivision restrictions limiting property use to single-family residential purposes alter the ability of the Airport Authority to purchase land and sell it for nonresidential use?

Goal: Reduce the adverse impact of noise from major sources including railroads, major thoroughfares, and aircraft operations at the Memphis Airport. Develop a strategy that includes land use actions as well as reduction of airport noise and improved means of controlling the effects of airport-generated noise.

SUBSTANDARD HOUSING CONDITIONS

Issue: The large number of existing substandard units contributes to health and safety problems and a decline in the quality of life in the Memphis area, decreasing property values and tax revenues.

Goal: Upgrade or eliminate deteriorated housing to promote sound living conditions for all residents.

COMMUNITY FACILITIES--SERVICE AND FACILITY DELIVERY

Issue: Developing areas often have problems of subdivisions spotted through undeveloped farmland. This sparse development makes it difficult to provide services and facilities in a timely or efficient manner to the low density and small number of people to be served. Some of these existing neighborhoods have continued to develop or have redeveloped with a higher density and need upgraded services or facilities.

Goal: Provide adequate public facilities and services to improve the residential environment.

Provide adequate space for community facilities to maintain a level of service that will satisfy community needs and desires and provide for the health, safety, and welfare of its citizens.

URBAN DESIGN

Issue: In many areas the quality of the living environment is degraded by the excessive number, size, and location of signs; the lack of landscaping; and the lack of adequate buffering or screening between conflicting land uses.

Property acquired by the Airport Authority under its buyout program will often be located adjacent to residential land that will not be acquired. The reuse of the acquired property for nonresidential purposes must be planned and regulated in part through site design techniques to mitigate the creation of nuisances and to protect residents on the "acquisition" boundaries.

Goal: Incorporate high-quality design standards into site plans for land development projects.

ARCHITECTURALLY AND HISTORICALLY SIGNIFICANT PLACES

Issue: Architecturally and historically significant places are frequently destroyed due to deterioration, demolition, or unsuitable conversion.

Goal: Protect sites, buildings, and districts of architectural and historical significance.

FLOODING AND FLOODPLAIN DEVELOPMENT

Issue: Development within the floodplain may expose property to flood hazards and reduce the capability of the stream system to safely carry floodwater. In addition, unique natural areas and habitats may be damaged or destroyed.

Goal: Use wisely areas subject to flooding, taking into account the desirability of protecting unique areas and habitats.

Provide for the protection of land areas subject to periodic flooding and for the improvement of existing drainage facilities.

URBAN STORMWATER RUNOFF

Issue: Urban development creates impervious surfaces, increasing the amount and rate of stormwater runoff and flood hazard potential.

Goal: Reduce runoff from new development, where appropriate, to lessen its adverse impact.

SOIL EROSION

Issue: The erodibility of soils in Shelby and DeSoto Counties makes them extremely sensitive to poor agricultural and development practices.

Goal: Decrease the rate of soil erosion.

TRANSPORTATION SYSTEM INEFFICIENCIES

Issue: Traffic volume is distributed unevenly throughout the day; consequently, roads are built to handle peak-hour demand but are underused at other times.

The capacity of numerous streets prevents their accommodating traffic volumes during peak travel periods, resulting in a substandard level of service.

The road connection between American Way and Tchulahoma Road should be constructed. When this is accomplished, what will be the problems and opportunities created by the connection?

Traffic congestion in DeSoto County requires the extension of Rasco Road to relieve pressure on State Line Road and Goodman Road. Further reduction in congestion could be achieved through proper coordination, with transportation planning done by the Mississippi State Highway Department.

What are the implications for extending Raines Road through the Oakhaven neighborhood to the vicinity of the airport? Will the extension help create an environment for nonresidential uses?

Goal: Alter traffic patterns, controls, and volumes to regulate traffic flow so that existing road capacities can be effectively used to their realistic capacities.

Provide for a system of major thoroughfares which will enable the free flow of vehicular traffic from places of residence to places of employment, shopping, schools, and recreation.

Establish an adequate planning process that coordinates DeSoto County community planning with the broad transportation goals of the Mississippi State Highway Department.

IMPLEMENTATION

Issue: The potential economic impact on owners of property located outside the buyout area should be recognized. The relatively high noise levels in this area and potential financial policies of lending institutions may create financial hardships for these owners.

Zoning policies in Memphis and Shelby County should recognize the economic contribution of the airport and help create a positive setting for the airport operations. Stricter controls on residential uses and undesirable nonresidential uses should be implemented.

Zoning policies in Memphis and Shelby County should restrict residential development in proximity to the airport to avoid future problems resulting from high noise levels.

Can building code regulations to improve sound insulation in homes be enacted so that they can change automatically as the airport's noise contours change?

What will be the implications of building code controls as they shift in response to future changing noise patterns?

What effects will the proposed aircraft equipment and retrofitting of older aircraft have on the noise contours?

Will rezoning of the buyout areas be managed to avoid flooding the market with an excess of property zoned for nonresidential uses?

What is the market demand for warehousing and distribution land uses in Shelby and DeSoto Counties? Within buyout areas, how will holdout property owners affect the ability of the Airport Authority to assemble and sell land for redevelopment?

Will all of the land assembled in a buyout area remain in a residential zoning classification until all parcels are assembled to avoid hardships on residents remaining in the buyout area?

Although the Airport Authority has a legal right to purchase residential property in high-noise-impacted areas, how will land be acquired from property owners who are reluctant to sell?

Noise exposure levels produced by operation of the airport will change over time, and building code requirements linked to noise exposure levels will apply to greater or, perhaps, smaller geographic areas. Will update of noise exposure contours be conducted on a predictable periodic basis, and will administration of resulting building code requirements be conducted in an equitable manner?

Goal: Provide for future development through implementation techniques involving zoning ordinances, subdivision regulations, and building codes, while maintaining the protection of the public interest.

Provide development of public facilities, services, and improvements coordinated with funding sources within a Public Improvements Program and Capital Improvements Budget.

Establish an acquisition/reuse/disposition strategy to determine how to turn the airport buyout program into a positive force to contribute to community growth and the quality of life.

LAND USE PLAN

The land use plan for the Cities of Memphis, Southaven, and Horn Lake, and for Shelby and DeSoto Counties is a coordinated plan for the present and future community. The plan is an expression of goals and policies derived from the community planning program conducted by local planning officials, as well as from the special efforts undertaken by the Memphis Airport land use study.

The land use plan contains elements that address:

- The overall arrangement of land uses in the study area
- Organization of community-serving private and public uses into well-located activity centers
- Redevelopment plans to guide reuse of areas acquired during the Airport Authority's buyout program
- Techniques and issues for mitigating the aircraft noise problems
- Transportation problems
- Roads and public facilities

FUTURE LAND USE MAP

The land use plan recommendations are depicted on the Future Land Use Map (Figure 1). The recommendations and map are for the 20-year planning period to the year 2010. The map identifies and establishes the pattern of development, location of land uses, and the relationship of the uses to each other.

The color code is identified in the map legend. Yellow represents low-density residential uses, and brown represents the high-density residential uses, such as apartments and condominiums. Red represents commercial/offices uses, with planned office uses shown in tan. Light industry and warehouse uses are shown as gray, with heavy industry represented by black. Planned business park uses are indicated by orange. Public uses are shown in blue.

The study area is focused on the airport and the surrounding employment center which includes the commercial, industrial, warehouse, and office uses in the corridor between I-240 and Winchester Road. A second employment center is located in the northern portion of the study area around the Army Defense Depot.

Low-density residential areas dominate the remainder of the study area with a variety of housing types and conditions. Development of some of the older subdivisions in the northern part of the study area began in the 1930s, while development in the southern part of the study area is continuing today.

In general, the plan recommends the protection of established, low-density neighborhoods from encroachment of commercial and industrial uses. The plan also recommends that residential uses along major roads not be converted to strip commercial use. Commercial activity centers are identified on the map to serve the residential and employment areas.

In developing areas, the future use of vacant land has been established to be compatible with existing development, as well as to provide for future growth needs of the community.

ECONOMIC PROJECTIONS

In general, economic projections for the study area are very optimistic. It is projected that industrial development in the area over the next 20 years will require approximately 1.3 million square feet of warehouse/distribution and industrial space annually (26.5 million square feet over the 20-year period). This will result in 1,000 new industrial employees per year. Office use in the study area is expected to produce an annual average demand of approximately 360,000 square feet of space (7.9 million square feet over the 20-year period), producing 1,200 jobs. Approximately 1.5 million square feet of retail space is expected to be needed in the study area over the 20-year planning period. The majority of the office and industrial development is expected to occur within the Tennessee portion of the study area, while the majority of retail and residential development is expected in Mississippi. These economic projections indicate a very active development future for the study area and demand that much attention be paid to the provision of infrastructure, coordination of roads, and the relationship between land uses. A more detailed analysis of the projected economic conditions is available in the Inventory and Analysis Report.

The main recommendations for the study area are:

Tennessee:

- The east/west I-240 corridor and the north/south I-55/Airways corridor will remain as important regional employment centers, containing uses such as the Nonconnah Corporate Center, Federal Express Corporate Headquarters, and the Defense Depot.

- The area east of Getwell Road will be developed as the major industrial employment center in the study area. The block located with Shelby Drive on the north, Malone Road on the east, Holmes Road on the south, and Getwell Road on the west will be an industrial center with a transitional area of light industrial uses on all road frontages to a core area of heavy industrial use.

- Encourage the redevelopment of strip commercial areas along Elvis Presley Boulevard, Airways Road, and Lamar Avenue into planned mixed-use developments with a variety of multifamily residential, office, and commercial uses.

- Major commercial uses should be located in commercial activity centers identified on the Plan Map. Strip commercial development should not be encouraged.

- Encourage the redevelopment of strip commercial areas along Elvis Presley Boulevard, Airways Road, and Lamar Avenue into planned mixed-use developments to contain a variety of multifamily residential, office, and commercial uses.

- Areas west and north of the airport remain as predominantly residential neighborhoods with supporting commercial uses in appropriate locations.

- These neighborhoods are to be protected from the encroachment of incompatible land uses. Any changes in these areas should be processed through the planned development (PD) process, requiring site plan review before approval.

- The Whitehaven/Airways Road buyout area extending from Winchester to the state line will be used for planned office development. The office area

will be separated from the surrounding neighborhood by a buffer strip. Vacant land and non-single-family uses, such as apartments, will also be designated for planned office use within the buyout noise boundaries and will be allowed to convert to these uses.

- The Charjean buyout area will be reused as a planned business park. An additional area along Airways between Ketchum and Pecan Circle east to the buyout area is recommended to be redeveloped as an entranceway area to provide increased access and visibility for the business park.

- Oakhaven will be preserved as a core residential neighborhood to the east of the airport. Swinnea Road is to be relocated to the present location of Nancy Road, and the portion of Oakhaven west of Nancy will be redeveloped for public uses. The plan will encourage the development of future business parks and light industrial uses to the south and east of Oakhaven. Residential uses between Shelby Drive and the Tennessee/Mississippi state line will not be expanded due to increased air traffic and potential noise impact.

- New zoning categories for planned business and planned office uses are recommended to be added to the zoning ordinance. These new zones will require that land development be extensively landscaped and buffered, and also receives site plan approval. These new zoning categories are described in the "Implementation" section of this plan.

- The areas south and east of the airport will be developed as a planned business park.

- The residential area located near the northwest corner of Getwell Road and Winchester Road is designated for planned redevelopment. The area is impacted by industrial and commercial activities, as well as aircraft and railroad noise. It should be converted to public or institutional use only if it is redeveloped as one site and as one application, using the PD process.

- The residential area located north of Knight Arnold Road, east of Tchulahoma Road, is designated for planned redevelopment. The area is totally surrounded by commercial/warehouse uses and is impacted by noise from aircraft, railroad, and major road traffic. This area should be converted to light industrial use only if it is redeveloped as one site and as one application, using the PD process.

- The large-lot residential area in the southeast corner of Winchester Road and Prescott Road is designated for planned redevelopment. This area should be converted to planned business park use only if it is redeveloped as one site and as one application, using the PD process.

- The mobile home park located north of Shelby Drive, west of Tchulahoma Road, is designated for planned redevelopment. This area should be converted to planned business park use only if it is redeveloped as one site and as one application, using the PD process.

- The residential area in the southwest corner of Holmes Road and Tchulahoma Road is designated for planned redevelopment. This area should be converted to planned business park use only if it is redeveloped as one site and as one application, using the PD process.

- The Nonconnah Creek floodway is designated as an environmental corridor that cannot be filled or developed.

- The Jackson Pit dump site, located near the southwest corner of the intersection of Shelby Drive and Tchulahoma Drive, is designated as an environmental corridor that cannot be developed.

Mississippi

The land use pattern in Mississippi represents continuing growth and development. With the exception of the central core of Southaven and Horn Lake, the majority of the development has occurred recently and is mostly of a suburban residential character. The main recommendations are:

- The land west of the existing Southaven industrial park to Horn Lake Road and south from State Line Road to the Southaven city limits is designated as a planned business park.

- An urban activity center containing a shopping center, hospital, and other facilities serving regional customers is proposed for the Goodman Road/I-55 interchange area of Southaven.

- The buyout area in the Greenbrook neighborhood of Southaven will be used for public-use facilities, with the adjacent area to the east between Swinnea Road and Tchulahoma Road to be used as a planned business park.

- The buyout area in the townhouse development on Danforth Lane and Woodshire Road is designated for office use.

- The area within Tchulahoma Road on the west, the Tennessee/Mississippi state line on the north, Malone Road on the east, and Goodman Road on the south will be developed for large-lot residential uses. This area is designated for low-density use due to the expected continuation of aircraft activity in the southeast direction.

- In Horn Lake, industrial, commercial, and business park activities will be the predominant uses between Hurt Road and I-55.

- In Horn Lake, a planned business park is designated for the area located along the I C Railroad north of Goodman Road and west of Highway 51.

- In Horn Lake, a public-use/recreation facility is designated for the area north of Goodman Road and east of Tulane Road.

- Low-density residential development is designated for areas surrounding Horn Lake and Southaven.

- Business park, office, commercial, and multifamily uses are designated for the I-55 corridor.

- The development of a planned business park zoning category (planned industrial zone) and a planned office category is recommended for Horn Lake, Southaven, and DeSoto County.

- Major commercial uses should be located in commercial activity centers identified on the Plan Map. Strip commercial development should not be encouraged.

COMMERCIAL ACTIVITY CENTERS

Commercial activity centers are recommended to provide a basic shift from the traditional strip commercial pattern to a pattern better described as a suburban shopping center or highway commercial center. The "center" is intended to provide more than retail or service commercial uses, will include other types of activities, and will be a focal point of the neighborhood, community, or region. Activity centers should be located in relation to school sites, open space, and office uses. Professional services should be an integral part of the center, as well as medium- to high-density housing.

Public and quasi-public uses are also encouraged to be an integral part of the activity center. Recreational or community centers, churches, and similar facilities can serve as focal points for an area, and shared parking facilities can reduce the need for large, extensive parking areas.

One of the most important aspects of the activity center concept relates the size of shopping areas to the markets they are intended to serve. Isolated or strip commercial developments unrelated to the residential area they are intended to serve will be replaced over time by the activity center concept as an integrated part of an overall planned community design.

To implement activity centers, the planned development concept should be employed. Applicants seeking approval of development plans should specify the market area they intend to serve, how they will incorporate into the development or be able to integrate with existing or proposed development the major uses, and functional relationships to be provided by activity centers.

Activity centers are divided into four classifications. Neighborhood centers are designed to meet daily convenience and personal living needs. Community and, to some extent, regional centers accommodate a wider range of service, merchandise, and personal service activities. Regional and urban centers provide activities for general merchandise, apparel, furniture, and furnishing needs at two different levels.

Commercial areas of less than 15 acres are not categorized. These sites are small convenience areas that serve surrounding neighborhoods or employment centers. Locations are limited and are not recommended except where identified on the Plan Map.

In addition to meeting shopping needs, the activity center should provide for offices, open space, recreational, semipublic, and public uses at a scale appropriate to the activity center.

Dedication, donation, public benefit features, or public purchase of land for needed public facilities should be pursued in and adjacent to activity centers. Cooperation among private land owners and public agencies is essential to the implementation of the mixed-use activity center concept. The planned development process can facilitate this cooperation and implementation strategy, achieving the multiuse character of activity centers.

The activity centers designated on the Plan Map are primarily existing zoned centers. Additional centers not shown on the Plan Map are not recommended without

substantial retail and service commercial market justification. Each neighborhood or community does not necessarily warrant a corresponding activity center. A community center, for instance, could also serve the local or neighborhood commercial needs of one or more neighborhoods within proximity to the community center. Each neighborhood and community must be analyzed to determine the appropriate number and type of activity center to serve it. Activity center standards are listed in Appendix A.

Activity Center Guidelines

1. Commercial activities shall be provided in planned centers as depicted on the Plan Map, utilizing the planned development process, rather than on scattered sites.

2. The amount and type of commercial uses in activity centers should be related to the service area's market demand.

3. The activity center should be planned and constructed as a cohesively designed development. Coordination between adjacent property owners should be encouraged with land use incentives.

4. The center should include housing that provides shelter opportunities for all socioeconomic groups.

5. Open space, plazas, parks, or similar amenities should be required in the activity center.

6. Public and quasi-public uses, such as fire stations and churches, should be encouraged to locate in and/or adjacent to activity centers to help establish the center as a focal point for the area and to share parking facilities.

7. Pedestrian access should be an integral part of the activity center design linking residential areas, open space, schools, commercial areas, and other facilities.

8. Innovative site design, including building siting, streetscape elements, planting screens, and internal landscaping, should be encouraged.

9. Vehicular access to activity centers should be provided to major arterials at locations that will not impair the efficiency and operation of the roadways.

10. Vehicular circulation between uses within the activity center should be provided, but not be dominant.

11. Vehicular access between residential and commercial uses in the activity center is encouraged, provided through-traffic traversing the residential area is minimized.

COMMUNITY FACILITIES

A detailed review of community facilities was carried out as part of the Inventory and Analysis Report. Please refer to the volume of this study for more information. In general, community facilities are adequate and are in place in the older parts of the study area or are being provided as growth occurs in the developing areas. The general needs for each category of community facilities are summarized in the following section.

SCHOOLS

Memphis and Shelby County

There are adequate school facilities to serve the developed area. However, it will be necessary to make administrative decisions on closing and expanding schools as the school-aged population shifts and ages. Maintenance of existing facilities will be important, and expansions are expected to occur at various existing school sites. The developing portion of the study area east of the airport is planned to be business park and industrial uses, reducing the need for new school locations. No new school sites are expected during this planning period.

Southaven

During this planning period, population in Southaven is expected to double. As residential development occurs, schools will have to keep pace with the increase in the school-aged population. This can be accomplished to some extent by expansions of the existing schools. However, as the city expands geographically to the east and southeast, there will be need for another elementary school. It appears that the junior/senior high may be adequate to centrally serve the community and should be expanded at the appropriate time.

Horn Lake

Horn Lake population is expected to double during this planning period. However, the existing school facilities will be adequate for several more years. As growth occurs, there will be a need for another middle school. Sites should be reviewed for acquisition in the southern and southwest portions of the community.

FIRE PROTECTION

Memphis and Shelby County

There are nine City of Memphis fire stations located in the Memphis and Shelby County portion of the study area. In addition, there are eight city fire stations located on the fringe of the study area that help provide fire protection to the area. The Memphis Fire Department is proposing to construct a new station on Raines Road within the next five years. The new station will provide backup protection for a portion of the study area. Memphis fire station locations are based on a combination of factors, including response time, distance, and life hazard associated with land use type. However, response time is the main factor. Fire stations within single-family residential areas are located with a 3-mile, 3- to 5-minute response time as a maximum limit. The average response time for the Memphis portion of the study area is between 3 and 5 minutes and generally meets these standards. The majority of the unincorporated portion of Shelby County within the study area is also covered by the City of Memphis under an agreement with Shelby County. The remainder of the unincorporated study area is covered by a county station

located at 6675 Winchester Road. Response time depends on the location, but it may be as much as 15 minutes. Upon annexation of the Getwell West area, a fire station will be built at a site somewhere west of Tchulahoma Road. The construction of this station would bring the response time to approximately 2-1/2 minutes. If this annexation is completed, only the Holmes/Malone Road area east of Getwell remains within the study area to be served by the Shelby County Fire Department. Response time for that area is approximately 14 minutes from County Station Number Three.

Southaven

The City of Southaven operates two fire stations. Station Number One is located at 8779 Whitworth; Station Number Two at 8400 Greenbrook Parkway. The average response time is 3 minutes, and the total number of calls in Southaven in 1988 was approximately 600. The Southaven Fire Department is generally meeting a 3-minute response time throughout the city. As the community grows, a new station in the southern portion of the city will be necessary.

Horn Lake

The City of Horn Lake operates one fire station, and an additional station has been proposed to be constructed in the next five years. Although a site has not been selected, the station is expected to be located in the southern portion of the city. The existing station is located at 6670 Tulane Road. The average response time for calls in Horn Lake is 3 minutes, and the approximate number of calls in 1988 was 300. Horn Lake is generally meeting a 3-minute response standard, and a new southern station will help maintain that service level as the city grows.

DeSoto County

Other unincorporated portions of the study area in DeSoto County are covered by volunteer fire departments. One station is located in the DeSoto Woods Subdivision, west of Interstate 55. Summer Hill Station is located on Pleasant Hill Road in the easternmost portion of the study area. The average response time for these stations is 3 to 5 minutes. However, there are often long distances to be traveled, resulting in as much as a 15-minute response. The unincorporated portion of the DeSoto County study area has rural level fire service and will be upgraded as land area is annexed into Horn Lake or Southaven.

PUBLIC LIBRARIES

Memphis and Shelby County

The Memphis and Shelby County Public Library operates two branch libraries in the study area. The Cherokee Branch is located at 3300 Sharp, and the Parkway Village Branch at 4655 Knight Arnold Road. Six other libraries are located in adjacent neighborhoods, providing additional library service to the area. The South, Levi, Whitehaven, High, Gaston Park, and Poplar/White Station Branches are all with a 10- to 15-minute drive of the study area. No additional libraries are expected to be needed in the study area.

Southaven, Horn Lake, and DeSoto County

The First Regional Library System operates the M. R. Dye Public Library in Horn Lake, as well as the M. R. Davis Public Library in Southaven. Enlargement of both libraries is scheduled to take place by the year 2000. According the the First Regional Library System's 5-year plan, the Southaven facility will double its size, from 10,000 to

20,000 square feet. The Horn Lake facility will expand from its present 3,964 square feet to 7,000 square feet.

PARKS AND OPEN SPACE

Memphis and Shelby County

Within the Tennessee portion of the study area, there are 27 park sites, including the Mid-South Fairgrounds. Nineteen additional parks, as well as the Pink Palace Museum, are on the fringe of the study area and provide services to the area. McKellar Park, covering approximately 250 acres, is the only regional park in the study area. However, Audubon, King-Riverside, and Overton Parks, with a 10-mile service radius, provide significant, large urban park facilities to the study area. The area is also well served by six community centers in the area, as well as by five additional centers located on the edge of the study area. Magnolia and Bethel Labelle Community Centers have recently been upgraded, and the Orange Mound Senior Center is scheduled for expansion. Still another community center is being considered for the Oakhaven portion of the study area.

Twelve neighborhood parks, from 5 to 20 acres, are located within the study area, with another thirteen located on the study area's fringe. The neighborhood park site at Tchulahoma and Holmes remains undeveloped open space. Part of the Whitehaven area--between Highway 51 on the west, I-55 on the east, Shelby Drive on the north, and the state line on the south--is not served by a neighborhood park, but is within driving distance of McKellar Park. There are five district parks, from 20 to 100 acres, located in the study area. Two of these--Nash Buckingham and Zodiac--are essentially undeveloped open space. In addition, four district parks with special facilities are located on the fringe: Halle Park with baseball fields and a football stadium; Fox Meadows and Pine Hills Parks with golf courses; and Toby Park with a softball complex and rugby field. Generally, the study area is well served by either those parks within the area or those on the fringe. An analysis of parkland indicates that two additional neighborhood parks and one district park will be needed to serve the Tennessee portion of the study area by the year 2010.

Southaven

This portion of the study area is primarily served by park sites adjacent to schools. There are neighborhood parks on the grounds of Hope E. Sullivan and Southaven Elementary Schools, as well as two soccer fields at Northwest Junior College. A district park is located at the Southaven Junior/Senior High School Complex, and another between Elmore Road and Swinnea Road. There is a Senior Citizen Center in Southaven. There are no regional parks provided in Mississippi for Southaven residents, but McKellar Park in Memphis does serve that area. Additional equipment and facilities may be needed in the existing park sites as surrounding population densities increase. Based on the current and projected population for Southaven, there will be need for an additional neighborhood park by 2010. A large urban park located to serve both Horn Lake and Southaven will also be needed by then. Land should be acquired prior to development or dedicated to the city as part of the land development process.

Horn Lake

This portion of the study area is served by three parks that are adjacent to schools. Horn Lake Junior High and Horn Lake Elementary Schools both provide neighborhood park facilities. Horn Lake High School provides the only district park facility. The corner of Goodman Road and Tulane Road is the site of a neighborhood park, while a neighborhood park site has been dedicated in the DeSoto Village Subdivision in the western portion of Horn Lake. There are no regional parks or community centers in Horn Lake. Currently, the city's parkland appears to be sufficient for the existing population. As

the city grows, so will the need for additional parkland. Based on the current and projected population, Horn Lake will need a 5-acre neighborhood park and a 20-acre district park by the year 2010. Land should be either acquired prior to development or dedicated to the city as part of the land development process. There is need for a regional park located to serve both Horn Lake and Southaven.

DeSoto County

There is one dedicated park in the eastern portion of the study area, located on Shady Oak Drive east of Getwell. This neighborhood park will serve subdivisions that are currently under development.

As Horn Lake and Southaven continue to grow, there will be a demand for a large urban park. A combined population of almost 35,000 people is projected by the year 2010. A site of approximately 100 acres should be centrally located in the southern portion of the study area to serve the entire north DeSoto County area.

SANITARY SEWER FACILITIES

Memphis and Shelby County

All of the study area within Tennessee lies within the service boundary of the City of Memphis wastewater system. The service area is referred to as the Nonconnah Creek Drainage Basin. Wastewater collection in the basin is provided by a series of gravity interceptors, all flowing into the Nonconnah Creek Interceptor, which parallels the creek and eventually flows westward to the T. E. Maxson South Treatment Plant.

There are currently no major deficiencies in the existing Nonconnah Creek wastewater collection system. The majority of the study area in Tennessee is presently served by sanitary sewers. The only exception is the southeast corner, near the intersection of Holmes Road and Malone Road (Drainage Basin NS-9). The City of Memphis is currently planning an extension of the main interceptor in Basin NS-9, which should bring sewer service closer to the area. A small portion of the study area on the north lies within the Wolf River drainage basin (Basin WS-3). This area is fully developed and adequately served by existing sanitary sewer lines.

DeSoto County

The southern portion of the study area, south of the state line, lies predominantly within the Horn Lake Creek drainage basin. Sanitary sewer service to this area is provided by the Horn Lake Creek Interceptor Sewer District. This utility district provides wastewater collection through a series of interceptor sewer lines and pump stations. All wastewater is transported to the T. E. Maxson South Treatment Plant for treatment and disposal by the City of Memphis.

Existing developments in some portions of the Horn Lake Creek Interceptor Sewer District drainage basin are presently served by a series of wastewater pumping stations. This situation is a result of development outpacing the construction of major sewer interceptors. The District has developed a 10-year plan for expansion of its collection system in order to eliminate many of the pump stations. Expansion will also open up new areas for development by providing sewer service availability.

The southeast corner of the study area, south of the state line and east of Getwell Road, lies outside the service area of the Horn Lake Creek Interceptor Sewer District. Sewer service to this area will require the extension of existing interceptors by the District, as well as the construction of pump stations. However, neither the City of Memphis nor the Horn

Lake Creek Sewer District has plans for providing sewer service to this area. Alternately, septic tanks can be used, subject to the limitations of soil conditions, site topography, and applicable septic tank regulations. In either case, the rate and type of future development will be limited by the lack of public sewer service in the area.

All wastewater from the study area eventually flows to the T. E. Maxson South Treatment Plant, which is owned and operated by the City of Memphis. This plan has a capacity of 80 million gallons per day (MGD), with present flow to the plant being approximately 60 MGD. Based on population projections for the study area, it is estimated that 27 percent of this plant's excess capacity will be required to serve the 2010 population. However, this plant also serves the entire Nonconnah Creek Drainage Basin, which includes all of southeast Memphis. The South Treatment Plant's present capacity will be exceeded prior to 2010. It is anticipated that the City of Memphis will expand this treatment as necessary to accommodate future growth.

MAJOR ROADWAYS

TENNESSEE:

MEMPHIS AND SHELBY COUNTY

The Memphis Airport area is an automobile-oriented area containing 35 major road corridors designated in the MPO Major Road Plan, and limited public transportation. Sixteen of these corridors are east/west facilities, and 19 are north/south. The remaining 2 roadways are part of the Interstate Highway system, providing regional access to and from the airport area.

The traffic projections and analyses for the Memphis Airport area are based upon the future land use and their related traffic production and attraction attributes. A computer traffic modeling program was utilized to generate projected trips from the area's traffic analysis zones. These trips were assigned to the major road plan network for capacity analysis.

MAJOR ROAD PLAN ANALYSIS

The computer analysis of the protected 2010 land use on the current Major Road Plan indicates that the proposed system is not sufficient to accommodate projected traffic by the year 2010. The system modeled all major roads, including Priority 3 roadways, as if built to standard in the year 2010. The analysis found that the study area was deficient by 30 lanes, with 12 lanes needed in a north/south direction and 18 lanes in an east/west direction. The 12-lane deficiency in the north/south direction is primarily along roadways immediately surrounding the airport facility, those roadways being Mill Branch Road, Airways Boulevard, and Getwell Roads. The east/west deficiency of 18 lanes is evident along four corridors--I-240, Democrat Road, Winchester Road, and Shelby Drive.

SYSTEM DEFICIENCIES

The causes of these deficiencies are related to two transportation factors; the lack of adequate future road capacity provided by the Major Road Plan, and a road configuration which does not provide a sufficient number of alternative travel paths between origins and desired destinations. The capacity deficiencies related to the Major Road Plan are caused by the past deletion of roadway links and the inability to provide the recommended 1-mile grid system of major roads. The airport precludes the connection of both Raines and Knight Arnold Roads east and west of the facility, as well as a north/south roadway from I-240 to the state line in the general vicinity of Swinnea Road. In addition, segments of roadways have been lowered in classification, such as U.S. 78 and Getwell Road, resulting in a reduced capacity.

Suburban development, both residential and nonresidential, is becoming characterized by individual sites isolated from adjoining properties. These developments have individual points of access to major roads and few interconnections, thereby placing increased demands upon major roads to accommodate all vehicle trips, including those intrazonal trips that could be served through an integrated system of collector streets. A highly interconnected minor road network reduces the demand on the major roads for these shorter trips.

POLICY CONSIDERATIONS

Resolution of the system deficiencies in the Major Road Network requires study beyond the limits of the Memphis Airport area. The regional aspects of the traffic problems can be adequately addressed in the Major Road Plan update scheduled for 1992. While this update is under way, certain policies need continued consideration in the Memphis Airport area.

Below are the identified objectives for the study area and appropriate policies for development proposals in the interim.

1. Develop a major road network to allow traffic to travel through the study area without causing congestion.

2. Encourage the control of access on existing major roads and roads planned for through traffic as a means of protecting road capacities.

3. Develop a system of collector streets that better serves land uses and enhances the functions of major roads.

4. Encourage the extension of public transit to serve local residents, retail areas, and employment centers by providing an alternative to the automobile and a desirable level of service to its users.

5. Develop a highly interconnected minor road network that reduces demand on the major roads for shorter trips.

Policy Recommendations

1. Memphis and Shelby County should use the 1981 Major Road Plan, as amended, as the guide for constructing major roads in the study area.

2. The city and county should encourage the use of roadway design that protects the design capacity of major roads through the provision of median and curb cut controls.

3. The city and county should provide for safe and efficient movement of people and goods at a local level by insuring that developing areas are interconnected to each other and to service facilities.

4. Major roads that are anticipated to operate at better than acceptable levels of service should be developed in phases as demand for additional capacity arises.

5. The priority system for major roads should distinguish between the need by local government to provide full capacity of roadway corridor and the immediate need to provide adequate pavement width for urban development.

MISSISSIPPI:

As part of the study, several modifications are recommended for the Major Road Plan, as designated by the Metropolitan Planning Organization (MPO). These modifications, discussed later in this section, both expand upon planned roadway improvements previously defined by the MPO in the Major Road Plan and suggest new roads/roadway segments to be added to the plan. In Mississippi, it is recommended that Tulane Road be extended southward, swinging east to align with Hurt Road. The new alignment would extend the major road corridor to intersect with Church Road. The second

recommendation is the addition of an interchange on I-55 with Church Road; the addition of Rasco Road from Swinnea Road to Pleasant Hill Road; and the identification of a corridor for an east/west collector roadway halfway between Church Road and Goodman Road.

Along with the prospect of certain future population growth, the Metropolitan Memphis area can expect to experience a corresponding growth in traffic volume. Since a positive future growth trend is predicted to occur, possible transportation system deficiencies must be identified. The transportation assessment of the 2010 Land Use Plan involved estimating future traffic generation relative to the various land uses prescribed by the plan. Altogether, the traffic volume generated by the planned uses, along with the forecasted "through" traffic volumes within the study area, was assigned to the study area roadways and tested relative to traffic-carrying capacity of the roadway system. Planned roadway projects which will increase the capacity of the existing system were also factored into the analysis.

ANALYSIS OF PLANNED CONDITIONS

The study area roadway segments were defined in the initial report prepared for the Memphis Airport land use study. This Inventory and Analysis Report lists segments by changes in pavement and/or existing right-of-way widths, as well as links between major arterials. For example, when a roadway's right-of-way changes upon entering an underpass or crossing a railroad track, the segments before, at, and after the change were studied. There are approximately 200 roadway segments in the study area. Appendix B also provides the width of each roadway segment's cross section and right-of-way, provided by the Metropolitan Planning Organization's Long-Range Transportation Plan, along with the corresponding volume-to-capacity ratio determined by projected traffic and LOS designations. Even when roadway improvements listed in the MPO's Long-Range Roadway Transportation Plan for certain segments are assumed to be implemented, and the projected 2010 traffic volumes plus surrounding traffic volumes are considered, certain road segments will likely have traffic volumes which continue to exceed their traffic-carrying capacity[1] and will provide substandard service levels.

For this plan, the roadway segments (see Appendix B) which provide LOS E or F are considered deficient. Of the 209 study segments, 63 are projected to have daily traffic volumes which exceed the LOS D service volume threshold according to MPO criteria. The following paragraphs list the specific roadway segments in Mississippi that are considered deficient under the above conditions.

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[1]In general terms, highway capacity is the maximum rate-per-hour at which vehicles can reasonably be expected to pass a fixed point on a roadway under prevailing conditions. Each roadway-facility type (e.g., freeway, arterial, and local street) has associated with it a range of operating conditions related to the amount of traffic it can carry. The range of operating conditions defined by using levels of service (LOS) are defined for each roadway-facility type and given a designation of A through F. LOS A represents the best prevailing operating conditions, and LOS F the worst. LOS D represents the minimum desired operating conditions for roadway segments. A segment-by-segment listing of the daily traffic volumes is shown in Appendix B, where they are listed with the maximum amount of traffic the segment can carry and still meet the LOS D standard (listed under LOS D, Service Volume).

ROADWAY SEGMENTS WITH PROJECTED TRAFFIC CARRYING CAPACITY DEFICIENCIES

When any one roadway segment experiences a traffic capacity problem, a number of acceptable methods are available to address it. Typically, a common treatment is to provide additional traffic volume capacity through widening of roadways. In the case of the future land use plan's impact on the adjacent roadway network's capacity, it is not necessarily practical to provide geometric widening for each roadway which displays future capacity deficiencies. For many reasons, including cost of right-of-way, the lack of available land for right-of-way, fixed geometric (structural) limitations (e.g., bridges and railroad tracks), and priority scheduling of capital improvements, the addition of geometric roadway improvements for each deficient segment would be cost-prohibitive for most communities. Sections of Goodman Road in Horn Lake, Southaven, and DeSoto County which presently have widening improvements planned also display traffic volume projections which will create deficient daily operating conditions even after the improvements are constructed. Roadway widening projects by themselves cannot provide all of the future roadway capacity needed to handle future traffic. Provision of transportation system management projects can also help solve roadway capacity problems.

DeSoto County

- Goodman Road from Tchulahoma Road to Getwell Road
- Church Road from U.S. 51(S) to Tchulahoma Road
- State Line Road from Tchulahoma Road to Malone Road

Southaven

- Goodman Road from I-55 to Tchulahoma Road
- Mill Branch Road from State Line Road to TN/MS state line

Horn Lake

- Nail Road from Tulane Road to U.S. 51(S)
- Goodman Road from Horn Lake Road to Tulane Road
- U.S. 51(S) from Church Road to Goodman Road

TRANSPORTATION SYSTEM MANAGEMENT (TSM) CONCEPT

The primary objective in Transportation System Management (TSM) is to encompass a range of improvement strategies that have a low capital cost compared to road construction, and also use demand management and supply optimization for the existing highway network facilities to achieve the transportation-related goals. The foremost goal in this study is to identify potential future transportation problem areas where vehicular traffic flow becomes impeded and to recommend strategies to alleviate them. Actions taken to improve vehicular traffic flow typically employ traffic engineering measures which optimize the existing transportation characteristics (e.g., roadway space, traffic signals, transit series, and parking availability). Such actions try to decrease traffic congestion by reducing travel time and delay while increasing travel speed. Such modifications can help to postpone or optimally eliminate the need for capital-intensive expenditures (e.g. major geometric modifications) aimed at increasing the roadway's traffic-carrying capacity. Table 1 lists various TSM measures and their possible applications to expedite traffic flow.

TABLE 1

TSM TREATMENTS TO EXPEDITE TRAFFIC FLOW

	Application	
	Freeways	Streets
Lane and Capacity-Related Treatments		
1. One-Way Streets		X
2. Restriping to Create More Lanes	X	X
3. Use of Freeway Shoulders as Lanes	X	
4. Reversible Lanes		X
5. Reversible Roadways	X	X
6. Control of Median Opening Spacing		X
7. Closure of Median Openings		X
8. Closure of Short Gaps in Thoroughfares and/or Frontage Roads	X	X
Intersection and Turning Movement-Related Treatments:		
1. Intersection Widening (Turn Lanes)		X
2. Multiple Exclusive Turn Lanes		X
3. Modified Peak Period Lane Use at Intersections		X
4. Replacement of Intersection Left Turns with Far-Side U-Turns		X
5. U-Turn Lanes at Interchanges	X	X
6. Turn Restrictions		X
7. Two-Way Left Turn Lanes		X
8. Parking and Loading Restrictions (Peak Periods)		X
Signalization and Control-Related Treatments:		
1. Installation of Signalization and/or Timing Optimization		X
2. Progressive Signalization		X
3. Network Signalization		X
4. Removal of Unwarranted Signals		X
5. Removal of Unwarranted All-Way Stop Signs		X
Freeway Operations-Related Treatments		
1. Extended Freeway Exit (Auxiliary Lanes)	X	
2. "Reverse" (Transpose) Freeway Ramps	X	
3. Closure of Freeway Ramps(s) During Peak Periods	X	
4. Addition of Auxiliary Lanes(s) Between On- and Off-Ramps	X	
5. Addition of Auxiliary Lanes(s) on Service Roads at Entrance Ramps	X	
HOV and Transit-Related Treatments:		
1. HOV Freeway Entrances and Exclusive HOV Lanes	X	X
2. Relocation of Bus Stops to "Far Sides" of Intersections		X

Transportation System Management improvements can often be implemented when:

- New development occurs. The development of new land uses in a corridor should trigger the TSM treatments which, if implemented, would minimize the impact of new traffic.

- Capital improvement programs are reviewed. TSM treatments can be implemented to maximize those benefits to a community that can be realized from a limited capital investment.

- Breakdown conditions occur in the transportation system. Areawide growth often creates traffic congestion problems in adjacent built-out neighborhoods. Implementing TSM treatments as ongoing improvement measures will help counteract the areawide effects of growth on the highway system.

RECOMMENDED MODIFICATIONS TO THE MAJOR ROAD PLAN IN MISSISSIPPI

Based on the 2010 Land Use Plan's transportation analysis, a series of both geometric modifications and TSM-type recommendations are listed below and identified on Figure 3.

DeSoto County

Geometric Improvements and New Construction Improvements

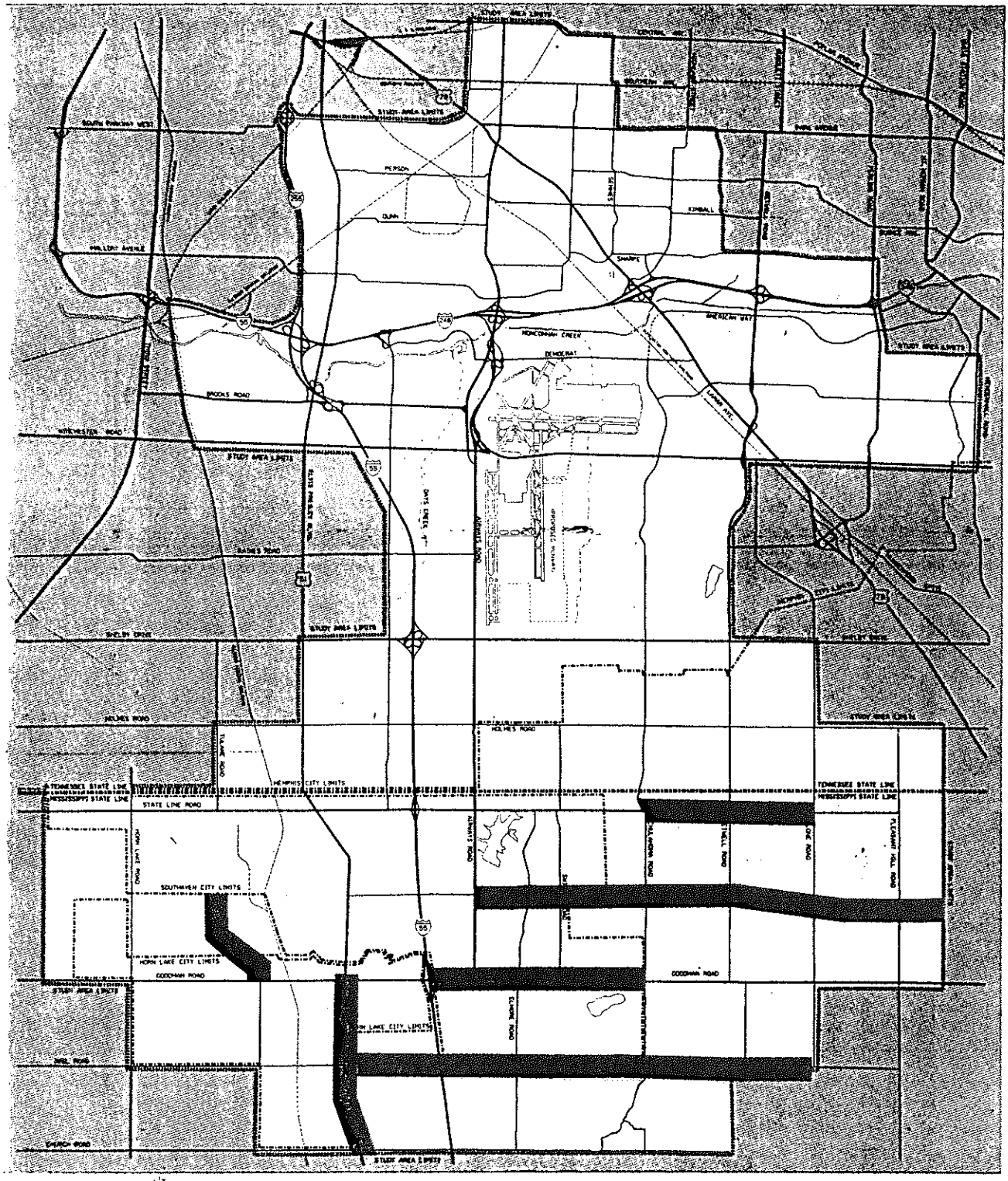
1. State Line Road. Along State Line Road from Tchulahoma Road to Malone Road, where currently two lanes exist, match the five-lane cross section that exists to the west in Southaven. This can be accomplished by adding one lane of pavement to the four-lane, undivided roadway cross section currently spelled out in the MUATS Long-Range Plans.

2. Goodman Road. Create a six-lane, median-divided cross section from Tchulahoma Road to Pleasant Hill Road, where the current two-lane section exists. Limit median crossovers to 1/4-mile spacing. Any new driveway curb openings become right-turn in and right-turn out along Goodman Road and should be spaced at least 100 feet apart.

3. Construct a four-lane, east/west collector roadway (Rasco Roadway extension) from Swinnea Road to Pleasant Hill Road, parallel to and halfway between Goodman Road and State Line Road. This will create a desirable 1-mile-spacing interval between major collector roadways in that part of DeSoto County. The roadway will also decrease the future traffic congestion burden along parallel portions of State Line Road and Goodman Road. The cost of such an improvement would be approximately $5.11 million. Any new two-way driveway openings along this road should be spaced no less than 200 feet apart.

4. Similarly, construct a four-lane, east/west collector roadway (Nail Road extension) halfway between Church Road and Goodman Road. This will further develop the 1-mile-spaced collector/arterial roadway network.

5. Construct a fully directional interchange at I-55 and Church Road to provide east/west access to the interstate.



MEMPHIS AIRPORT AREA LAND USE STUDY

MAJOR ROAD IMPROVEMENTS

SCALE 2000 0 2000 4000 FEET

CITY of MEMPHIS / CITY of SOUTHAVEN / CITY of HORN LAKE / SHELBY COUNTY / DESOTO COUNTY / MEMPHIS and SHELBY COUNTY AIRPORT AUTHORITY

RECOMMENDED MODIFICATIONS TO MAJOR ROADWAY PLAN

Barge Waggoner Sumner and Cannon

Engineers, Architects, Planners, Economic Advisors and Surveyors

FIGURE 3

BARGE, WAGGONER, SUMNER, and CANNON / in association with GA/PARTNERS GREINER, INC. HARRIS MILLER MILLER & HANSON SIEMON, LARSON & PURDY

City of Southaven

6. Goodman Road. From I-55 to Tchulahoma Road, match improvements suggested for Goodman Road in DeSoto County.

7. Match the cross section and extend the two east/west collector roadways to the west from their recommended western terminal points in the DeSoto County recommendation of this report.

City of Horn Lake

8. U.S. Highway 51. From Church Road to Goodman Road along the existing two-lane portion, restrict left turns to signalized intersections. At those intersections, provide adequate left-turn storage lanes. In this case, limiting left turns can only be expected to be a temporary measure. This section of U.S. 51 will eventually need to be widened to seven lanes to match the pavement cross section found in Southaven on U.S. 51. When this occurs, allow two-way driveways no less than 200 feet apart.

9. Tulane Road. Extend Tulane Road to the south from its existing terminus to connect with Hurt Road at the Hurt Road/Goodman Road intersection.

Although this study has identified possible roadway deficiencies, all segments that may have future problems are not recommended for immediate improvement. As a result of this analysis, the most cost-effective improvements were identified as having the highest priority, which would produce the greatest positive benefits to traffic circulation. Table 2 lists the recommended improvements, the approximate costs, and the relative priority of consideration within the jurisdiction.

TABLE 2

MISSISSIPPI

PRIORITY ROADWAY IMPROVEMENTS

Improvements	Priority	Text Reference	Comments
Southaven:			
Goodman Road	1	9	Six-lane divided cross section from I-55 to Tchulahoma Road
Rasco Road & east/west roadway (Nail Road) midway between Church and Goodman Roads	2	10	Rasco Road, four-lane from Airways to Swinnea; Nail Road, four-lane I-55 to Tchulahoma
Horn Lake:			
U.S. Highway 51 (TSM) Church Road to Goodman Road	1	11	TSM improvements; cost effective
U.S. Highway 51 widening (5 to 7 lanes); Church to Goodman Road	2	11	Seven-lane cross section Church Road to Goodman Road
Tulane Road extension; southern terminals to intersection of Hurt and Goodman Roads	3	12	Four-lane cross section
DeSoto County:			
State Line Road	1	4	Five-lane cross section from Tchulahoma to Malone
Rasco Road	2	6	Four-lane cross section from Swinnea to Pleasant Hill
Goodman Road	3	5	Six-lane divided cross section from Tchulahoma to Pleasant Hill
New 4-lane east/west roadway (Nail Road) midway between Church and Goodman Roads	4	7	Four-lane cross section from Tchulahoma to Pleasant Hill
I-55/Church Road Interchange	5	8	Provides east/west access to interstate

SPECIAL TREATMENT AREAS

Within the overall study area are four locations close to the airport which have been designated as "special treatment areas" (STA) because of their proximity to buyout areas. All of these areas have a substantial amount of residential use, and portions of all areas are in an Airport Authority Acquisition Program. The STA locations are designated as Charjean, Oakhaven, Greenbrook, and Whitehaven. Portions of these areas, except Oakhaven, are impacted by the 75 L_{dn} or greater noise contour. Numerous issues have been discussed which relate to the new land use patterns to occupy land located in the Authority's buyout area, a program undertaken to remove noise-sensitive land uses from high-noise-level areas. This section outlines future redevelopment plans for each STA.

Generalized site concepts and prototype site layouts are illustrated to explain the concepts. The plans establish the future land uses for the buyout areas and deal with problems that the new nonresidential uses might present to the adjacent residential neighborhoods. In addition, a sales assistance program is recommended for houses that are adjacent to the buyout property.

Site design techniques have been used to mitigate negative effects of aircraft and major highway noise. Landscaping, berming, and the special arrangement of buildings will be used for these purposes. Redevelopment will be designed with low-rise buildings located adjacent to the remaining residential lots.

Three of the STAs--Whitehaven, Charjean, and Greenbrook--deal with these vacant land redevelopment issues. The fourth area, Oakhaven/East Airport, has a buyout area related to the construction of new airport facilities and also has business development impacts that are critical to future stability.

Acquisition of STA land will progress based on funding availability from FAA grants, local bond issues to match those grants, and the voluntary agreement of property owners to sell their land. The properties are being acquired under the Airport Authority Acquisition Program, which has established an order of acquisition for each property owner who has applied to sell. This process is proceeding as efficiently as possible, but will take several years to complete. Properties are being purchased in all STAs, so acquisition for each STA is occurring simultaneously. This means that redevelopment will be dependent upon the acquisition program's ability to provide a marketable-sized site.

The demand for office space within the study area is expected to be approximately 360,000 square feet per year, and for industrial space, approximately 1.3 million square feet per year.

When the redevelopment of the STA property is initiated, it is expected to draw 20 percent of the market demand. Therefore, in the first 5-year period, a speculative site to accommodate approximately 50,000 square feet of office space and 200,000 square feet of industrial space would be a conservative approach.

However, a larger area should be made available as soon as possible for a potential major user who would have a larger acreage requirement.

Given the long-term process under which the STAs are being acquired, the amount and location of land available for resale will be limited. As part of this study, all STAs were reviewed for market potential. Following are the priorities for redevelopment.

TENNESSEE

Office Sites

All of the Whitehaven STA is designated for planned office use. One site was identified as having the best potential for resale and was set as first priority for redevelopment. The Whitehaven North STA, because of the extremely good visibility and access offered by both Winchester Road and Airways Road, was set as the first site to be marketed for office use. Because of the acquisition process, only a portion of the site may be available in the near future. When an appropriately sized site is acquired, the land should be made available for sale as part of an overall comprehensive site plan for the entire Whitehaven North STA. As more of the land is acquired and consolidated, it can be incorporated to enlarge the site.

Redevelopment of the other Whitehaven sites is not recommended until the Whitehaven North site has been at least 50 percent developed. This focuses the effort and redevelopment cost on one site. The remainder of the Whitehaven sites should be added based on market demand.

Business Park Sites

The Charjean STA is designated for planned business park use, which would include office, warehouse, research and development, and light manufacturing. This is the only noise buyout site available to take advantage of the projected demand for industrial space. Because of the relatively good transportation provided by Airways Road and I-240, it has been designated as the number one priority site for business park redevelopment. However, many improvements must be made to provide appropriate access to the site. This will prevent immediate reuse of the property. As an appropriately sized site is accumulated, it should be marketed as part of a comprehensive site plan for the entire Charjean STA.

Public Use

The Oakhaven STA buyout area is going to be used for airport uses and will not be resold.

MISSISSIPPI

The reuse of STA buyout property in Greenbrook will be mostly for public uses, with the exception of the townhouse development along State Line Road at Greenbrook Lake. This site should be marketed for office redevelopment as soon as acquisition is complete in order to take advantage of growing office demand in Southaven.

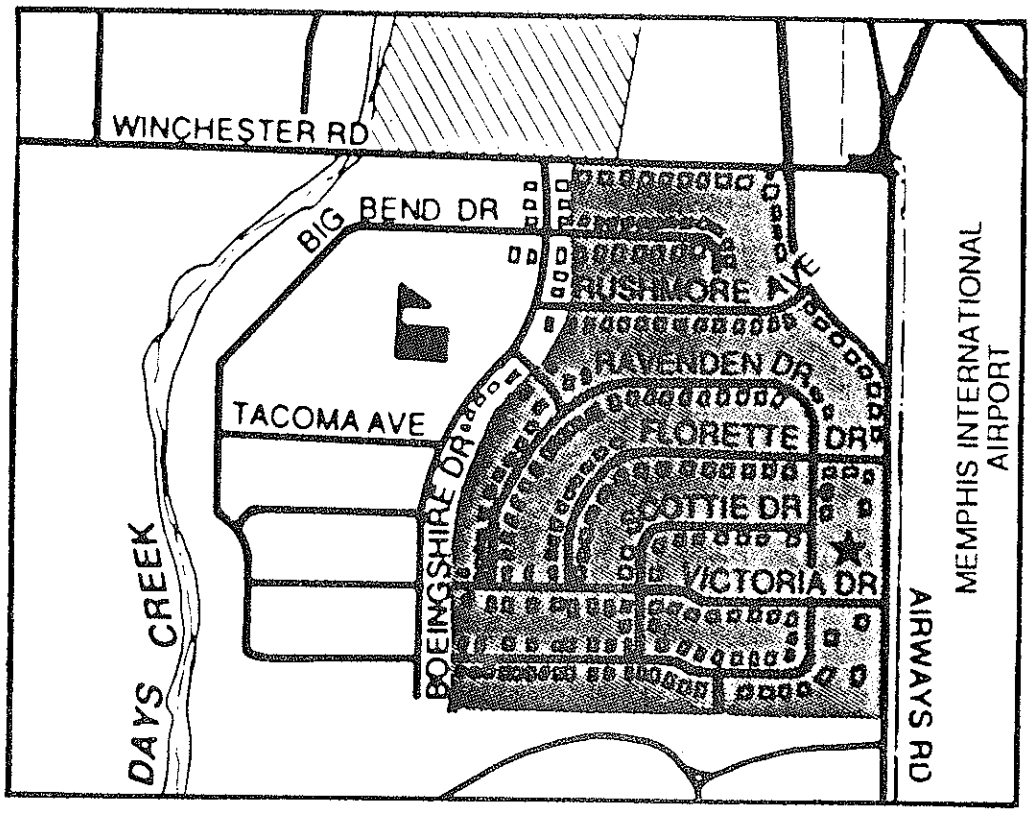
The following sections describe the recommended site redevelopment plans for each of the special treatment areas.

WHITEHAVEN

The Whitehaven STA is made up of four different areas west of the airport along Airways Road, between Winchester Road and Holmes Road. The northernmost area runs from Winchester on the north to the Federal Express Corporate Headquarters on the south. The eastern boundary is Airways and the western boundary is approximately Boeingshire Drive (see Figure 4). The site has an extremely good location, with frontage and visibility on two major roads--Winchester and Airways.

WHITEHAVEN NORTH

SPECIAL TREATMENT AREA



There are several areas in the buyout that parallel the airport on the west side. Beginning at the north end, the Canada Gardens area is the first. The acquisition boundary in Canada Gardens is a bell-shaped area bounded by Boeingshire* on the west, Winchester on the north, Airways on the east, and the Federal Express Corporate Training Center (CTC) on the south. There are approximately 248 homes in this area.

*Does not include houses that face or are adjacent to this street.

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MEMPHIS AIRPORT AREA LAND USE STUDY

FIGURE 4

WHITEHAVEN NORTH

The following guidelines define the development framework for the area.

1. The land use recommended for this site is planned office.

2. The generalized site development plan (see Figure 5) shows an internal orientation for the site's redevelopment parcels with two major gateway entrances, one on Winchester and one on Airways. Direct vehicular access from Winchester and Airways to development parcels will be provided by one access point off each of these major roads, with all delivery, employee, and customer access being handled by the site's internal street network.

3. Although access to the future office buildings will be internal to the site, the buildings themselves can be sited to face the major roads.

4. Three neighborhood streets that now cross the site and intersect with Airways will be closed. Rushmore Road, Florette Road, and Victoria Drive will be closed to discourage nonresidential traffic from entering the residential area west of the site and to permit the replatting of the site for office development. Rushmore Road and Victoria Drive, along with Big Bend Road North and Days Road, will be terminated on the east side of their intersection with Boeingshire (see Figure 5). Ravenden Road, Scottie Road, Berra Road, and Stallion Road--each located entirely within the site--will all be closed and the pavement removed. Colfax Avenue will be realigned along the southern boundary of the site to allow continued access from Airways to Boeingshire and the adjacent neighborhood street system. Streets will be terminated in a manner similar to Figure 6.

5. A landscaped buffer with an earthen berm will be provided along the western side of the site, adjacent to the rear lot line of residences facing Boeingshire. The buffer will be located in a manner similar to the concept plan in Figure 7.

6. A landscape planting screen along the frontage of Airways Road and along Winchester Road will be provided (see Figure 5).

7. Future buildings sited along the western portion of the property will be located to serve as a noise buffer to the adjacent residential structures.

WHITEHAVEN CENTRAL

The central portion of the Whitehaven STA is located south of the Federal Express Corporate Headquarters and extends along Airways to Shelby Drive. The area extends westward from Airways, varying in distance from approximately 650 feet to 1,100 feet to cover the buyout area (see Figure 8).

Guidelines for this portion of the Whitehaven STA are:

8. This continuous property will be redeveloped, with Raines Road and Goodhaven Drive remaining as a minor arterial and collector to connect the neighborhoods to the west along I-55 to Airways Road.

9. The land use recommendation for this site is planned office.

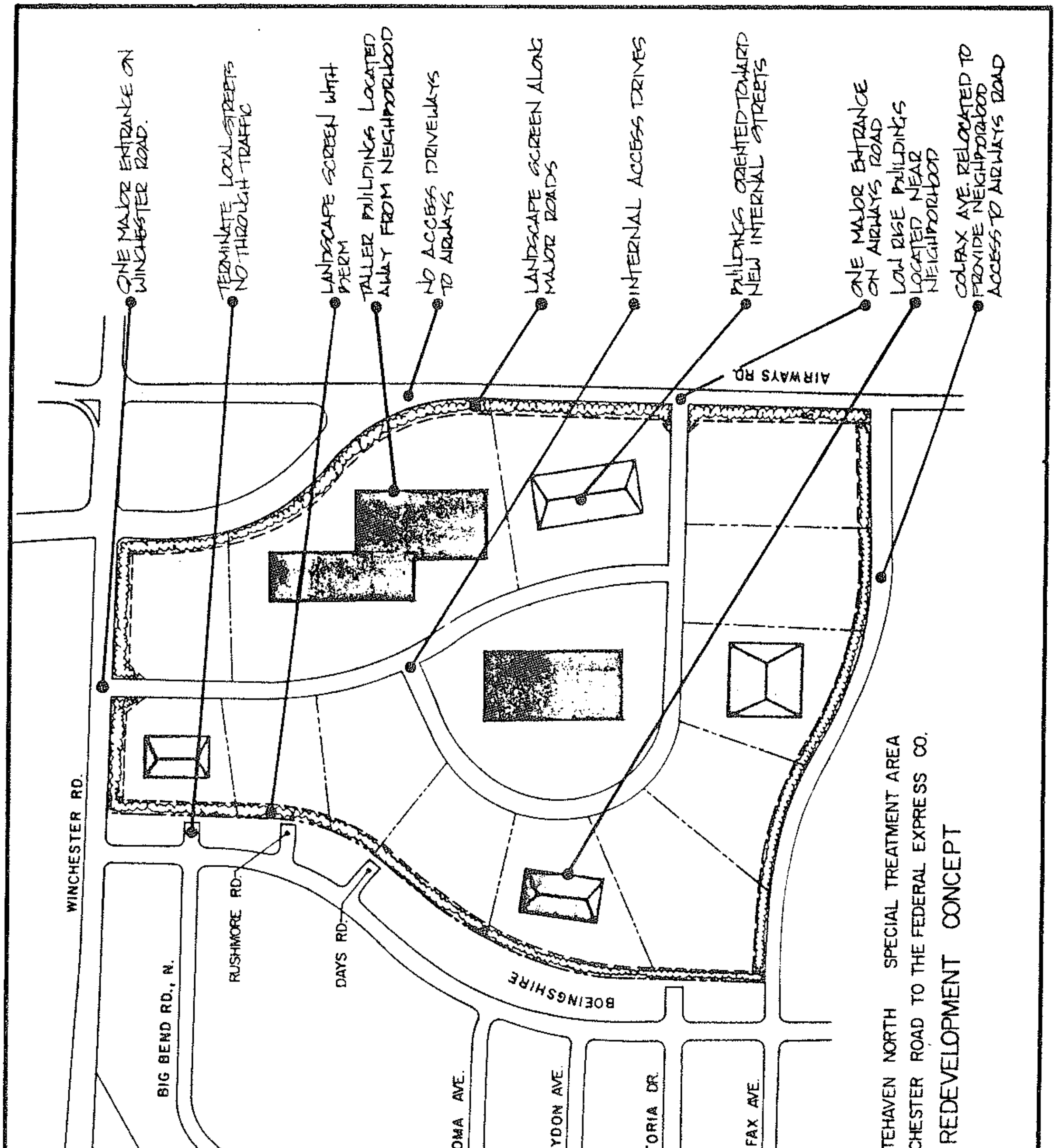

FIGURE 5

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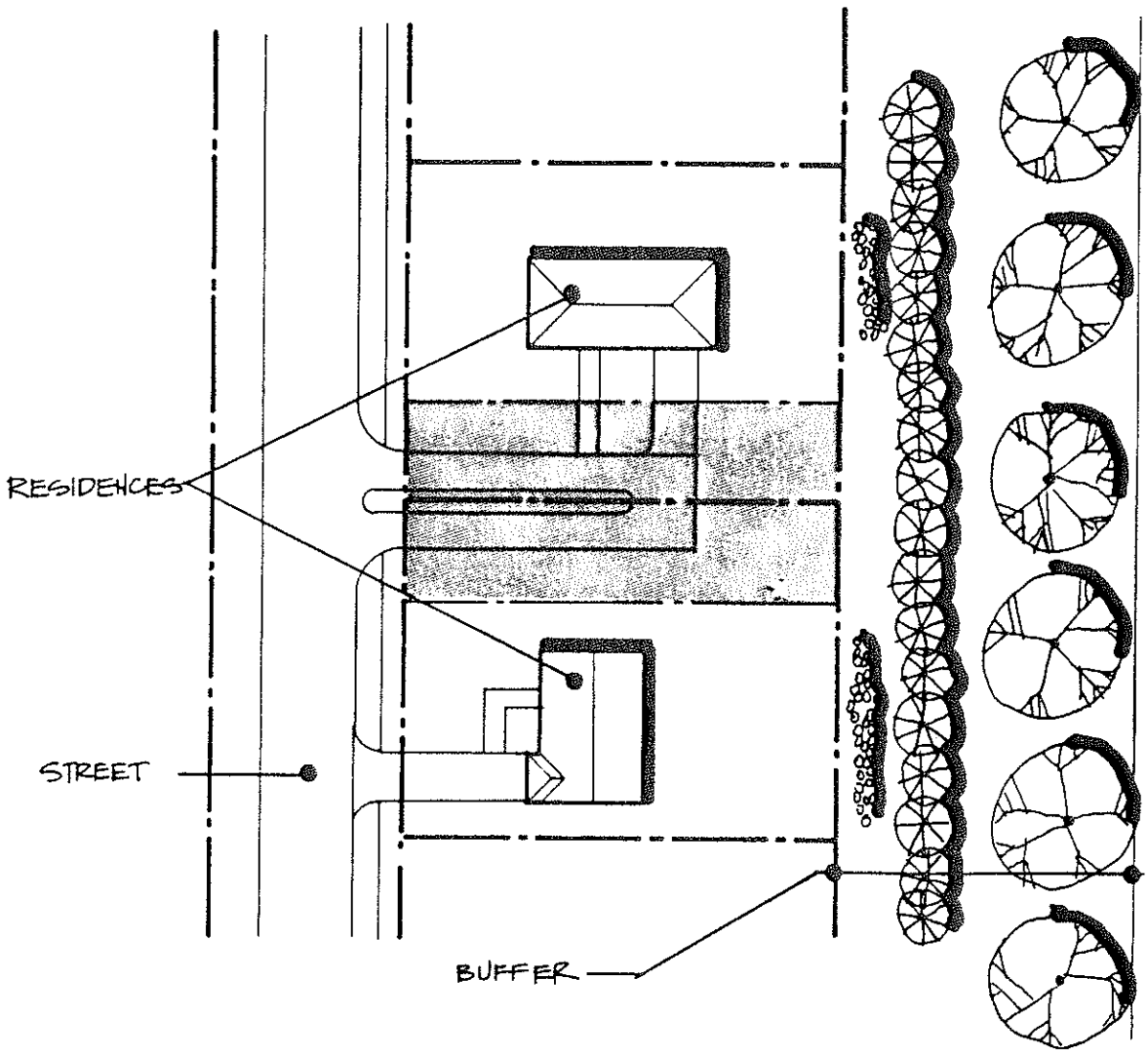
MEMPHIS AIRPORT AREA LAND USE STUDY

WHITEHAVEN NORTH SPECIAL TREATMENT AREA
WINCHESTER ROAD TO THE FEDERAL EXPRESS CO.
REDEVELOPMENT CONCEPT

in association with: CA PARTNERS GREINER INC. HARRIS MILLER MILLER & HANSON SIEMON LARSON & PURDY

STREET
CLOSURE CONCEPT



CLOSED STREET ADJACENT TO PROPERTY OWNERS

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MEMPHIS AIRPORT AREA
LAND USE STUDY

FIGURE 6

RESIDENTIAL BUFFER CONCEPT

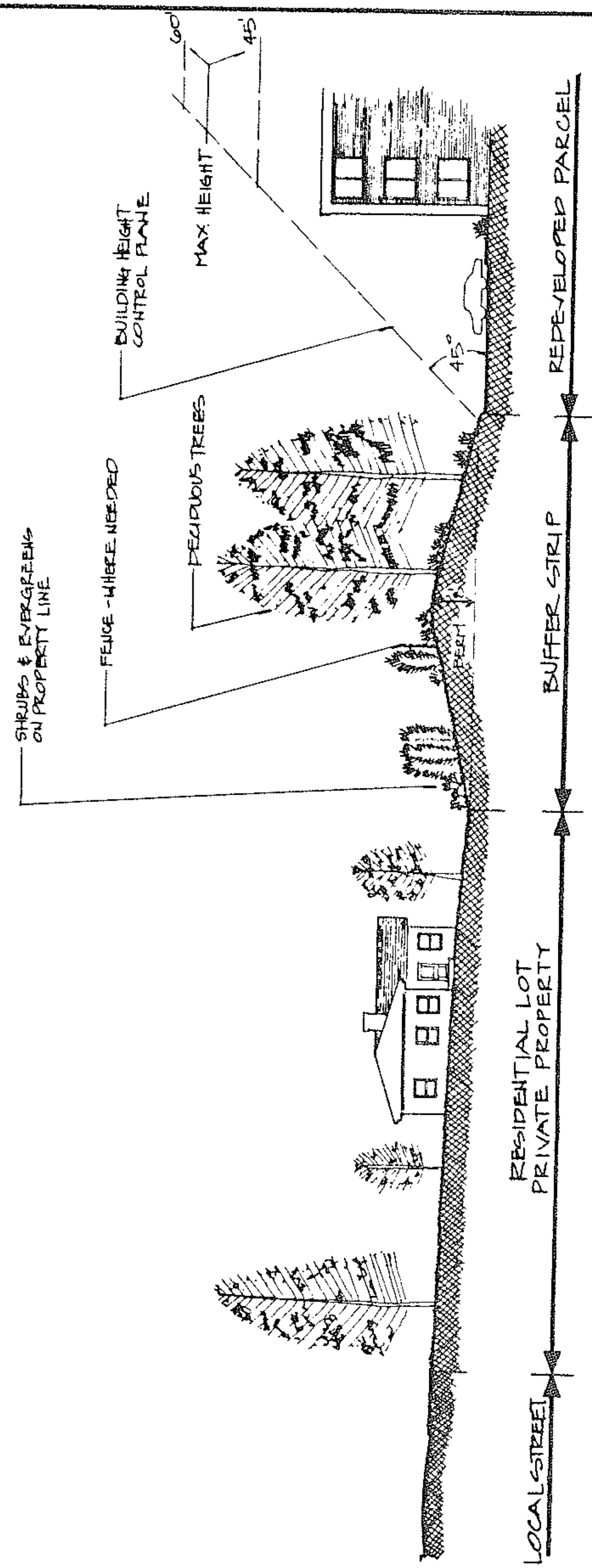

FIGURE 7

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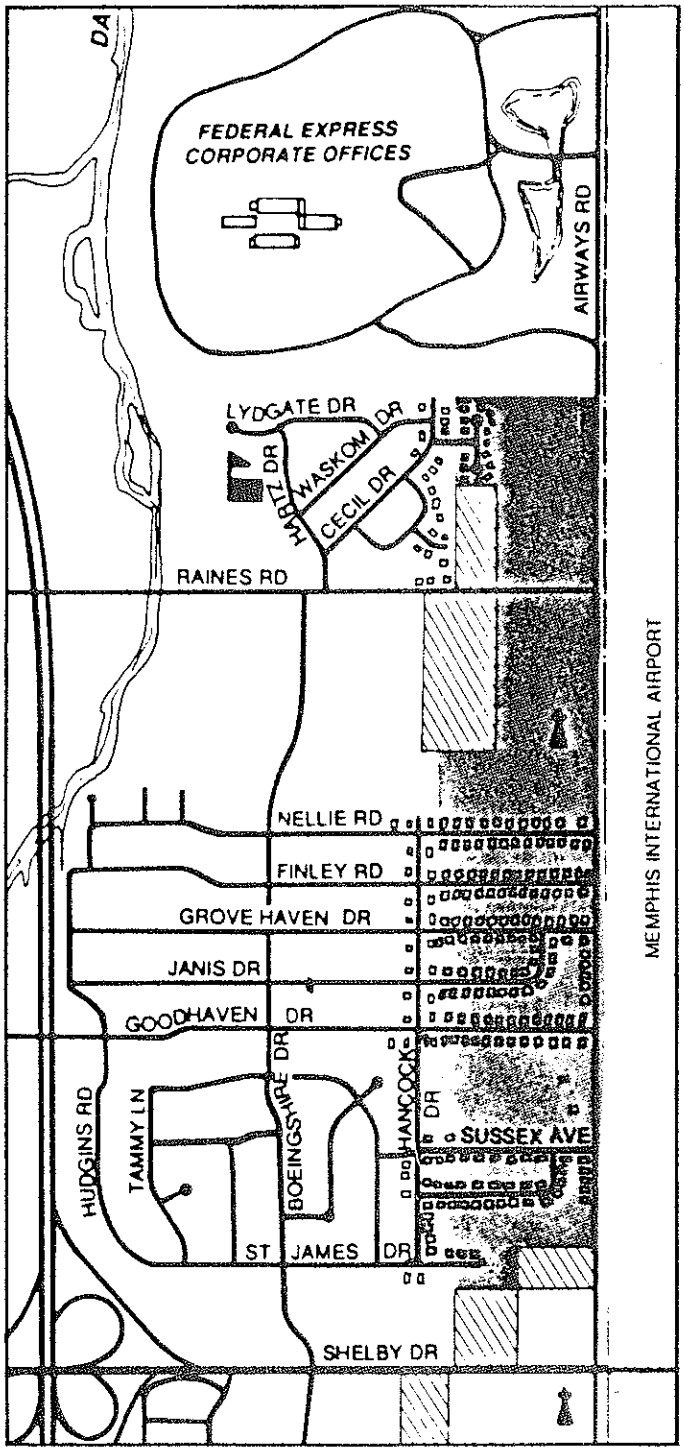
MEMPHIS AIRPORT AREA LAND USE STUDY

RESIDENTIAL BUFFER CONCEPT

in association with CA PARTNERS GRUNER INC HARRIS MILLER MILLER & HANSON SIEMON LARSON & PURDY

WHITEHAVEN CENTRAL SPECIAL TREATMENT AREA



The next group of homes includes a small portion of the Graceland Farms area and the Gardenview Subdivision. There are 13 homes in the Graceland Farms area and approximately 177 homes in the Gardenview Subdivision. It is approximately one block wide setting between Airways Boulevard and Hancock* and is bounded on the north by Federal Express (CTC) and on the South by Shelby Drive.

*Does not include houses that face or are adjacent to this street.

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MEMPHIS AIRPORT AREA LAND USE STURDY

FIGURE 8

10. The generalized site development plan (see Figure 9) shows an internal orientation for the site's development parcels, with four major gateway entrances on Airways Road and two entrances on Raines Road.

11. Direct vehicular access to redevelopment on the site will be allowed only from the internal roadway system.

12. Five neighborhood streets that connect to Airways will be closed. Nellie, Finley, Grovehaven, Janis, and Sussex Drive will be closed east of Hancock Drive, along with Glenmeade Street and St. James Drive. These streets will be terminated on the east side of their intersection with Hancock Drive. North of Raines, Lydgate Drive and Hancock Cove will be terminated east of Cecil Drive. All of the local streets will be closed similar to the concept shown in Figure 6.

13. A landscaped buffer with a berm will be provided along the western side of the site, adjacent to the rear lot line of residential lots. The buffer will be designed to be similar to the concept shown in Figure 7.

14. A landscape planting screen along the frontage of Airways Road, Goodhaven Drive, and Raines Road will be provided similar to Figure 9.

15. Future buildings along the west tier of development parcels will be located to serve as a noise buffer to help protect the adjacent residences from aircraft noise. Buildings will be oriented with activities toward Airways Road.

WHITEHAVEN SHELBY DRIVE/HOLMES ROAD

Whitehaven South area extends south from Shelby Drive to Holmes Road. This portion of the STA is dominated by a large site located south of Shelby Drive to Wilson Road (see Figure 10).

Guidelines for this portion of the Whitehaven STA are:

17. Future use of the site will be consistent with the planned office district.

18. Maplecrest Road and Jamie Drive that currently intersect with Airways Road will be closed within the site limit. Carmi Cove will also be closed near its intersection with Hancock. Maplecrest Cove, Corrozza Cove, and Jamie Cove will all be closed and the street pavement removed (see Figure 11).

19. All local streets will be closed and stubbed out in a manner similar to the sketch shown in Figure 6.

20. An internal roadway system will be developed with one major access on Shelby Drive and two gateway entrances on Airways Road.

21. Access to all redevelopment parcels will be from the internal street system.

22. All buildings will be sited to the extent possible to serve as noise buffers to help protect nearby residences from aircraft noise.

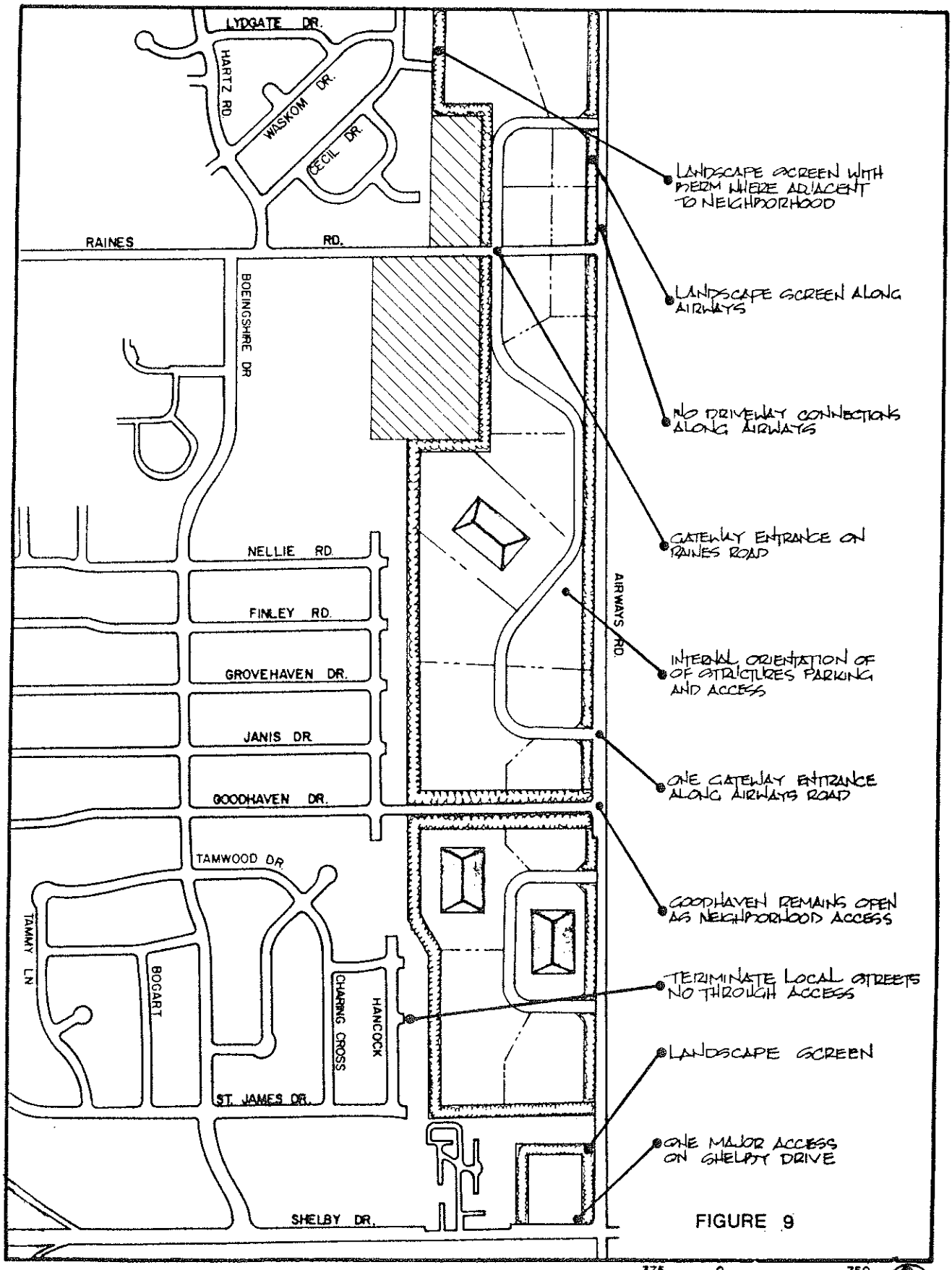

FIGURE 9

375 0 750

SCALE 1" = 750

N

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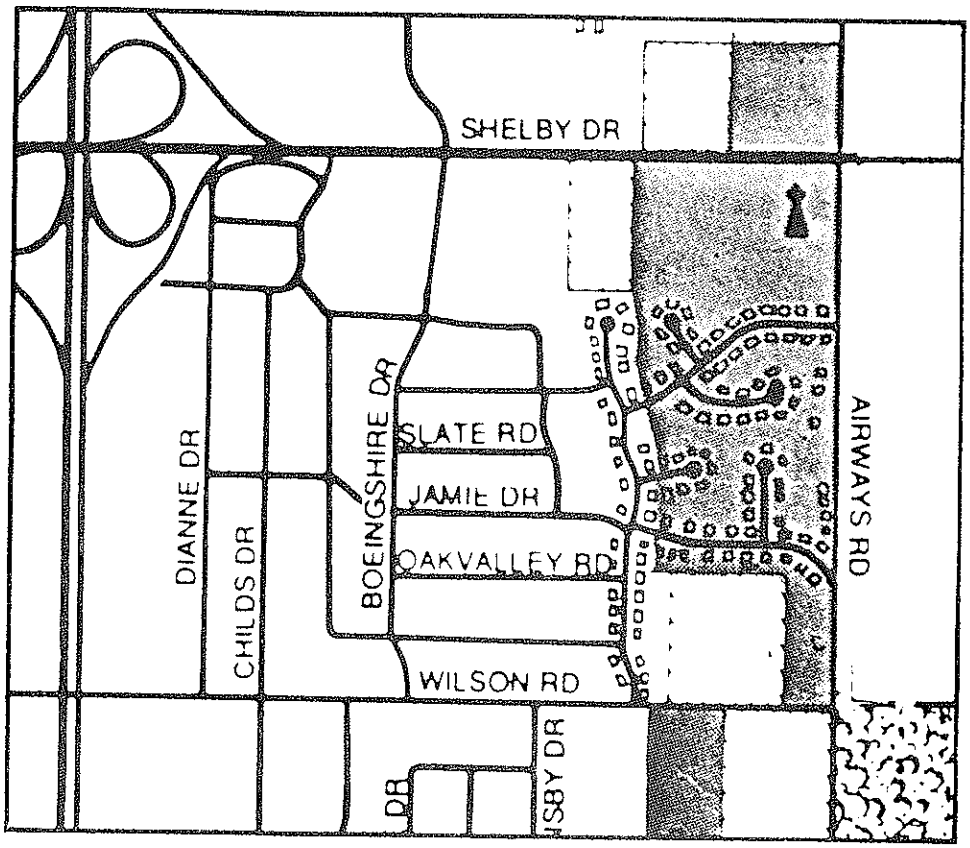
MEMPHIS AIRPORT AREA LAND USE STUDY

WHITEHAVEN CENTRAL SPECIAL TREATMENT AREA
FEDERAL EXPRESS TO SHELBY DRIVE
REDEVELOPMENT PLAN

in association with GA PARTNERS GRUNER INC. HARRIS MILLER MILLER & HANSON SIMON LADSON & PURDY

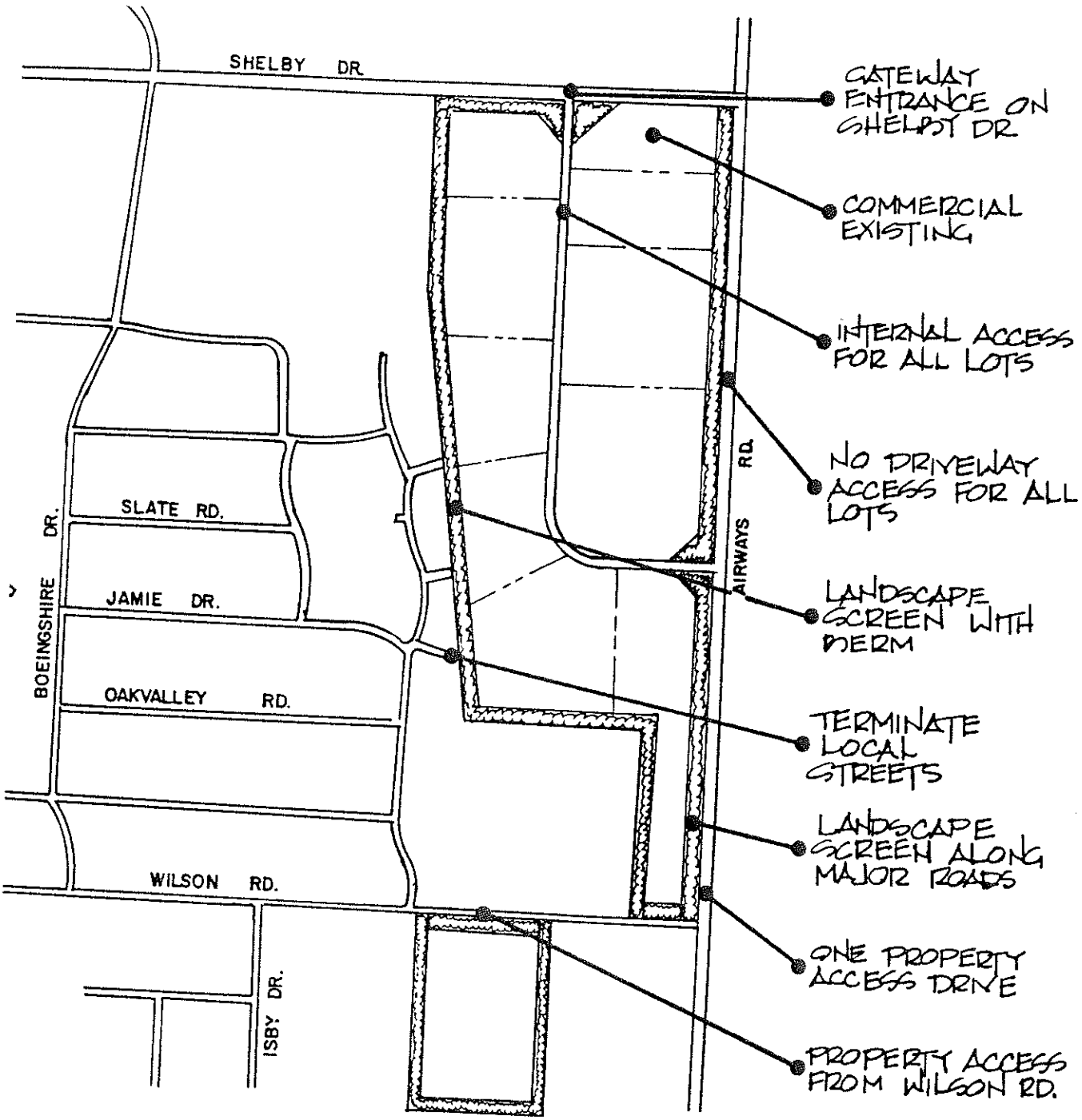
WHITEHAVEN - SHELBY DRIVE TO HOLMES ROAD SPECIAL TREATMENT AREA



The Red Oaks area is bounded by Hancock Drive* on the west and Airways Boulevard on the east. It includes Maplecrest, Maplecrest Cove, Carrozza Cove, Carmi Cove, Jamie, and Jamie Cove. It involves 79 homes.

*Does not include houses that face or are adjacent to this street.

WHITEHAVEN
REDEVELOPMENT PLAN
SHELBY DRIVE TO HOLMES ROAD



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MEMPHIS AIRPORT AREA LAND USE STUDY

FIGURE 11

WHITEHAVEN SOUTH

Another large site in the Whitehaven STA is located along Airways, from Holmes to south of the Mississippi state line (see Figure 12).

23. Future use of the site will be consistent with the planned office district.

24. Access to all redevelopment parcels will be allowed from an internal roadway system.

25. Oak Post Avenue, Broad Oaks Drive, Still Meadow Drive, and Shepards Tree Street will be closed and the pavement removed. Kilarney Avenue will be closed west of the intersection with Shepards Tree Street and stubbed out (see Figure 13).

CHARJEAN

The Charjean STA is a triangular area situated just north of the airport across I-240 and Nonconnah Creek. To the west of the area, across Airways Road, is the Defense Logistics Agency Depot. The Burlington and Northern Railroad forms the northeast boundary of the area and makes the third leg of the triangle. There are a variety of clustered land uses in this area. At the center of the area is Charjean Elementary School, which is nearly surrounded by single-family residences and duplexes. Along the western and southern edges of the area, most of the developed acreage is comprised of multifamily, commercial, and light industrial uses, while much of the land along the railroad is devoted to light and heavy industrial uses.

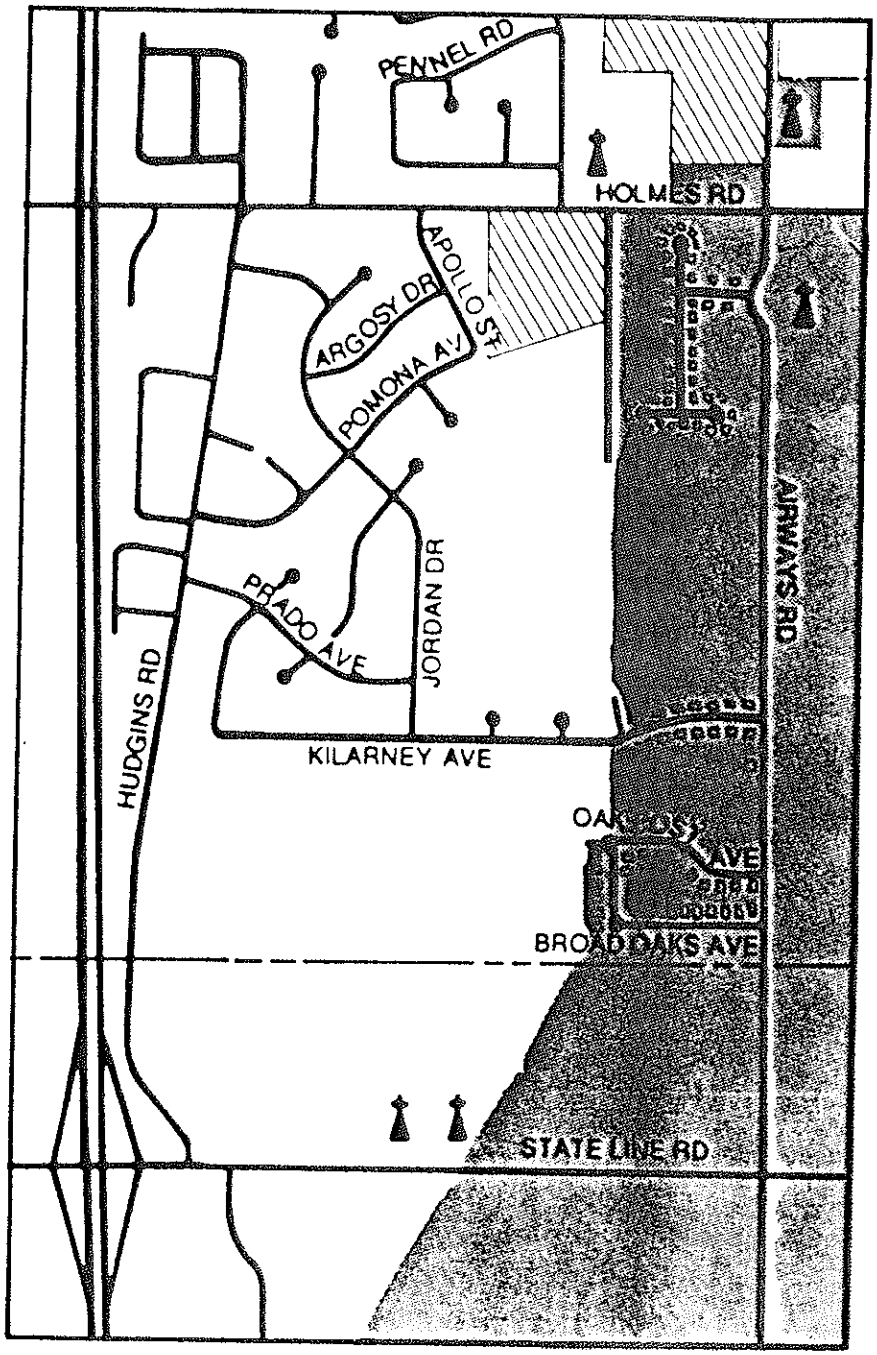
The buyout program will eliminate a large number of single-family houses in the center of the STA. To reuse the buyout property, the redevelopment area should be extended west to provide a visible frontage on Airways near its interchange with I-240. Expansion of the redevelopment area will eliminate a small pocket of residences on Pecan Circle and Joy Lane that would otherwise be surrounded by nonresidential uses (see Figure 14). This additional buyout will not be part of the Airport Authority Acquisition Program. A redevelopment authority will have to be formed to acquire the land.

Guidelines for the Charjean STA are:

1. The overall plan for this STA calls for its redevelopment with frontage along Airways Road. The redevelopment area extending from Pecan Circle to Ketchum Road and east to the limits of the buyout area will be used for business park purposes (see Figure 15). The houses on Pecan Circle, Joy Lane north of Ketchum, and Imogene between Ketchum and Cantor Avenue should be acquired, those streets closed, and pavement removed. The entrance area along Airways should be added to the buyout area and as Phase 1 of the redevelopment project. The business park's major entrance will be in the vicinity of the intersection of Pecan Circle and Airways Road. This will become the new alignment of Ketchum Road with Old Ketchum Road, terminated with a cul-de-sac just east of Airways Junior High School. Old Ketchum will continue to serve the school and other existing uses south of the current alignment.

2. The feasibility of extending Ketchum Road eastward to intersect with Lamar Avenue just north of the Lamar/I-240 interchange should be investigated. The extension will require the road to cross a railroad track and a stream; a safe location for an intersection with Lamar must be identified. If a road alignment is feasible, the area north and south of Ketchum should be redeveloped as a planned business park. This area along Ketchum will be a Phase 2 project and only redeveloped when Ketchum is extended to Lamar.

WHITEHAVEN SOUTH
SPECIAL TREATMENT AREA



A line approximately 1,000 feet west of Airways Boulevard that closely follows the 75 Ldn noise level, provides the western boundary for the more than 108 homes in Canterbury, Shamrock Village, and Windward Subdivisions of the acquisition area.

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MEMPHIS AIRPORT AREA LAND USE STUDY

FIGURE 12

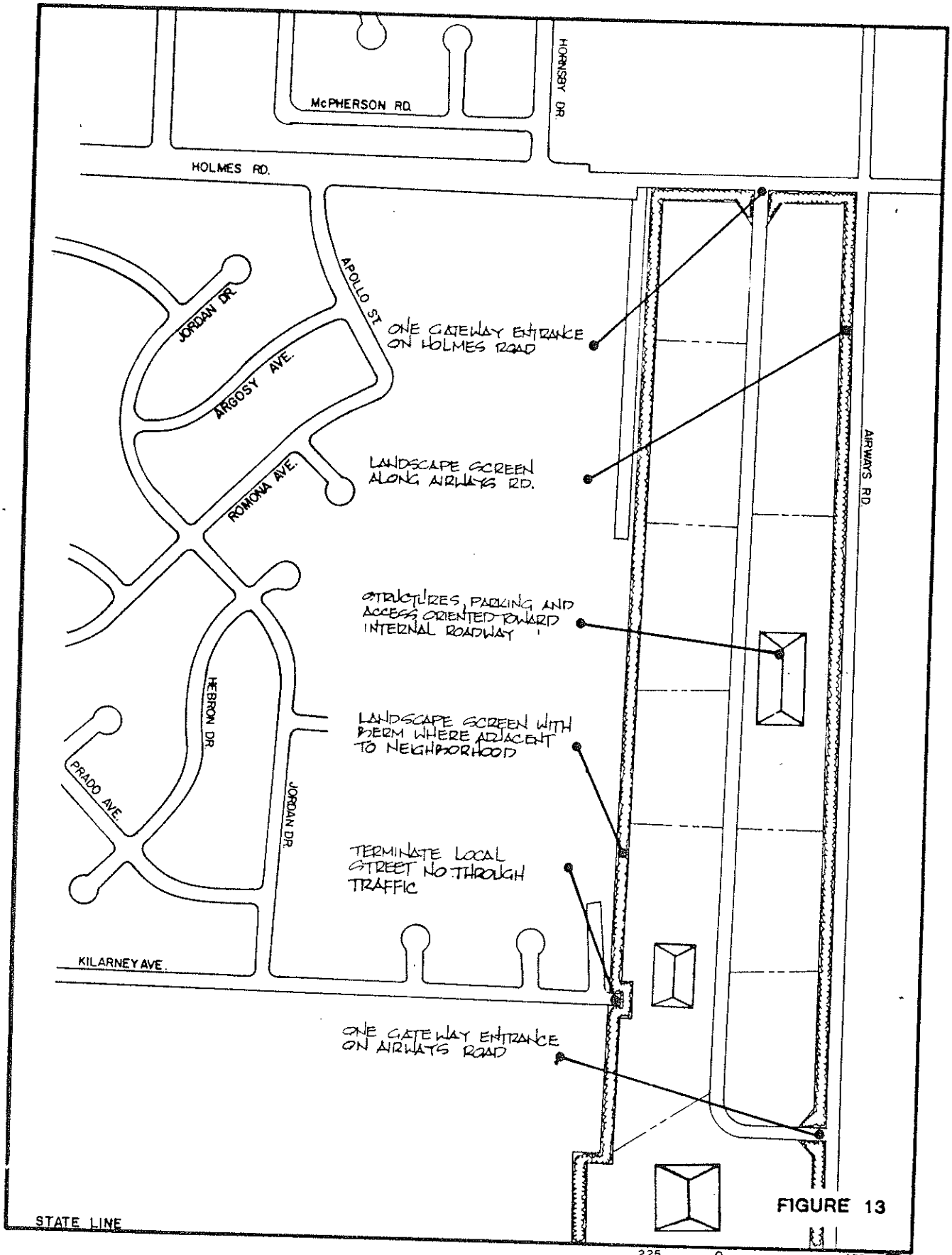

FIGURE 13

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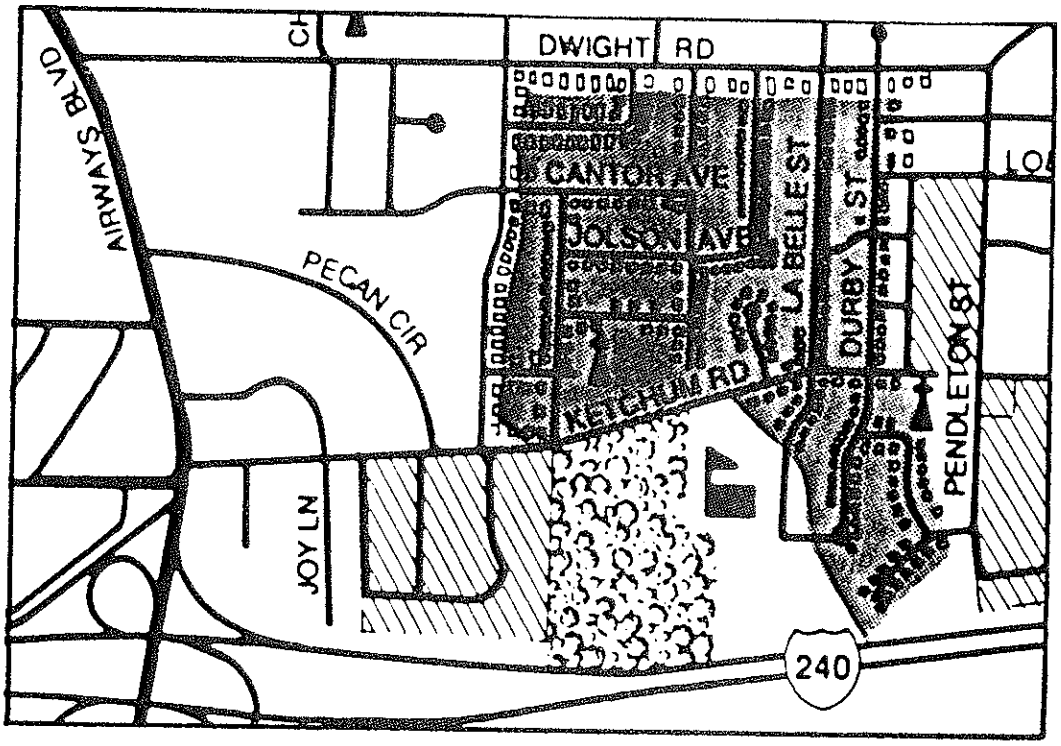
MEMPHIS AIRPORT AREA LAND USE STUDY

WHITEHAVEN SOUTH SPECIAL TREATMENT AREA
HOLMES ROAD TO STATELINE

REDEVELOPMENT PLAN

In association with CA PARTNERS GRUNER INC HAVENS MILLER MILLER & HANSON SIMON LARSON & PURDY

CHARJEAN SPECIAL TREATMENT AREA



The Charjean Park Area is the largest of the buyout areas, located directly north of the airport complex and Interstate 240. This area includes approximately 340 homes. The area is bounded by Dwight* on the north and Imogene* on the west. The south boundary is Ketchum and the east boundary is Durby. The remaining portion of this area is south of Ketchum and located between Airways Junior High and McLemore Church.

*Does not include houses that face or are adjacent to this street.

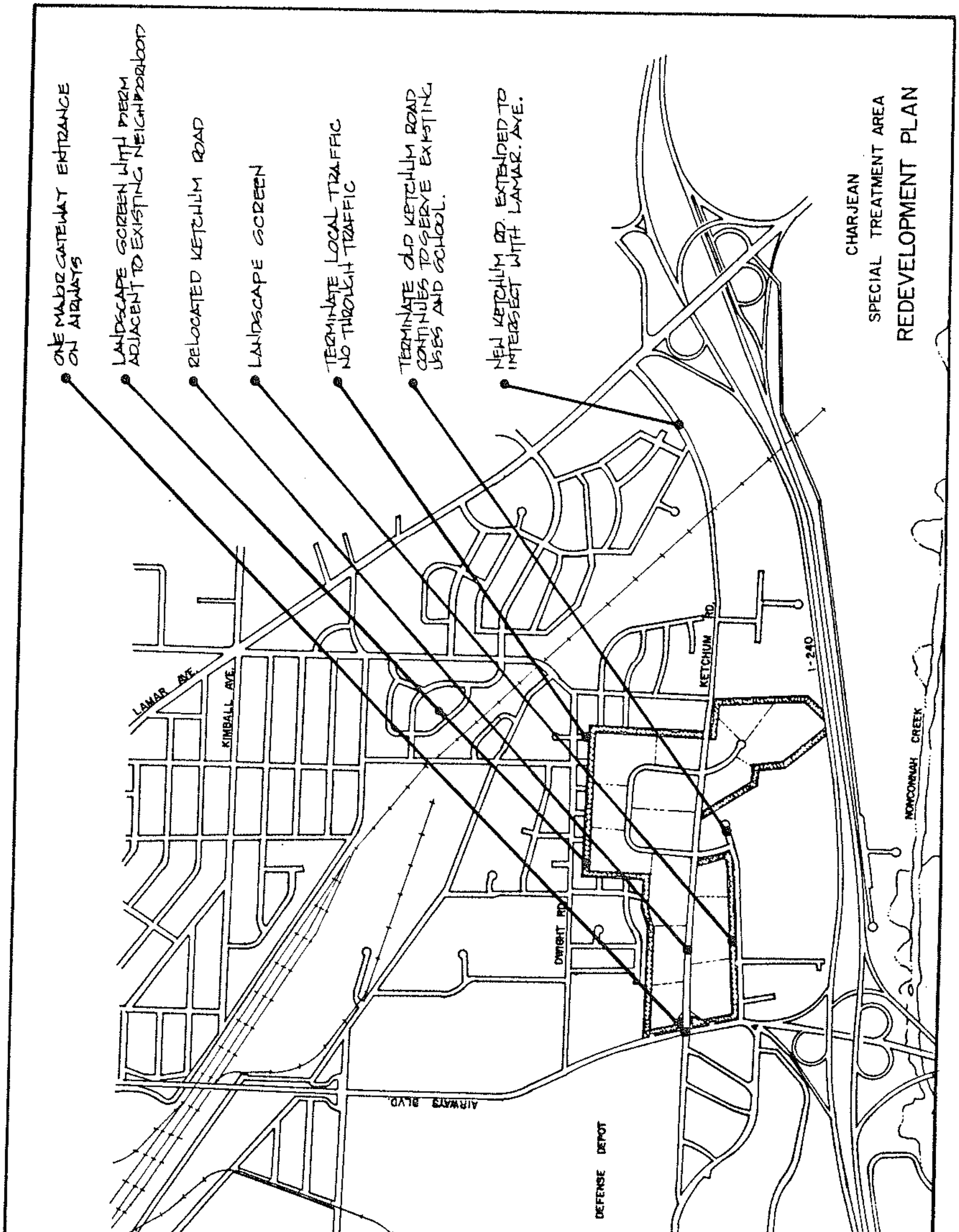


FIGURE 15

750 0 1500
SCALE 1" = 1500'

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Barge Waggoner Sumner and Cannon

MEMPHIS AIRPORT AREA LAND USE STUDY

CHARJEAN SPECIAL TREATMENT AREA
REDEVELOPMENT PLAN

3. Within the expanded redevelopment/buyout area, all existing residential streets are to be closed or stubbed out. Street closings will include Pecan Circle, Joy Lane north of Ketchum Road, Judith Street, Cantor Avenue, Stanfill Street, and Imogene Street; on the north, Long Street, Crosby Street, Barrymore Street, Labelle Street, and Durby Street just south of their intersection with Dwight Street; and on the east, Byrd Street and Lola Street just east of their intersection with Shelley Street.

4. Another part of the buyout area extends south of Ketchum, east of Airways Junior High School, west of Pendleton, and north of I-240. Labelle Street, Durby Street, Shelley Street, Robert Street, and Alcy Road will be closed in this area, and the street pavement removed.

5. The entire site will be redeveloped with an internal street system similar to the concept shown in Figure 13. A landscaped buffer strip will be provided along the boundaries of the business park site to protect the adjacent users from this activity center (see Figure 7). All buildings will be oriented toward the internal roadway system, and Ketchum Street will be realigned to serve the new business park development. The existing intersection of Ketchum and Airways will be used for direct access to the remaining uses in the southwest quadrant of the STA, including a large apartment complex, some single-family houses, Charjean Park, and Airways Junior High School. The existing Ketchum roadway will be ended near the entrance to Airways Junior High, with continued access from the new alignment of Ketchum Road.

GREENBROOK

The Greenbrook STA is a fan-shaped area that extends south from the airport property and includes land in Memphis, Shelby County, and Southaven. About half is developed with residential and estate uses, with the other half being agricultural or vacant. Virtually all of the residences are located in the Greenbrook Subdivision in Southaven (see Figure 16).

The following guidelines are recommended for the Greenbrook STA:

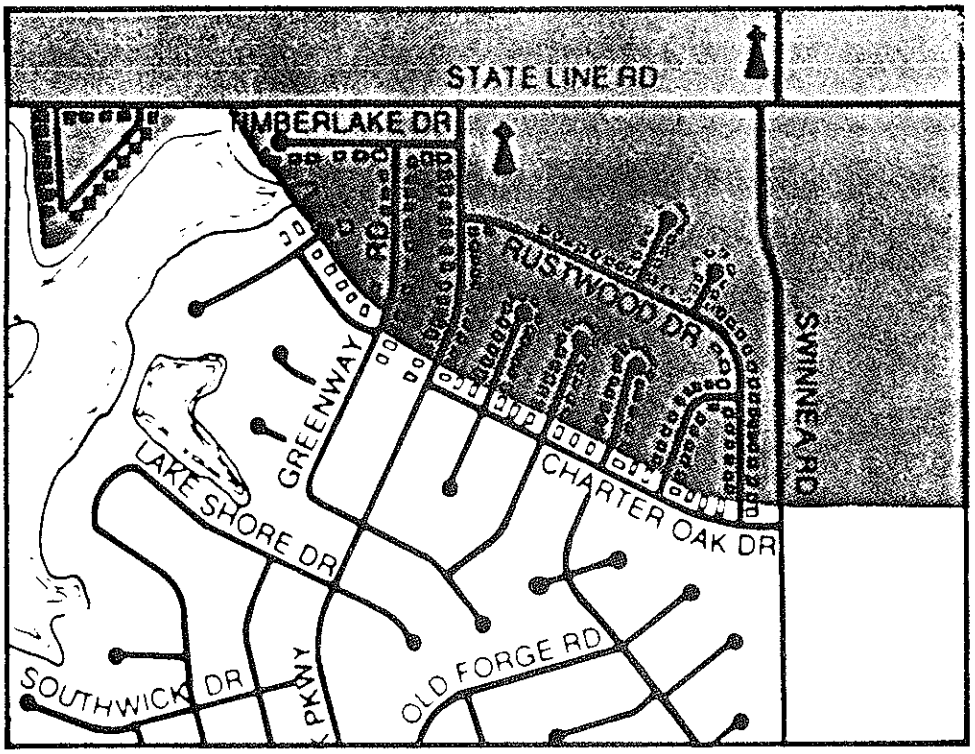
1. Within the Greenbrook Subdivision, the land should be used for public-use facilities. This includes civic buildings and other public facilities that will be compatible with the adjacent neighborhood. A privately operated golf course was also discussed as one potential use for the land (see Figure 17).

2. In all cases of reuse, the lake frontage that is adjacent to State Line Road should be treated to prevent public access to the private lake. A 50-foot-wide maintenance corridor along the lake edge should be transferred to the Greenbrook Homeowners' Association through either a land swap, a purchase, or a dedication. The lake frontage access should be controlled in future redevelopment by a fence to separate any public uses from the lake.

3. Greenbrook Parkway will continue to provide the major access to the subdivision from State Line Road.

4. Within the Greenbrook buyout area, several streets will be closed and the pavement removed. Fairfield Place, Brookfield Place, and Timberlake Drive will be closed; Greenway Road will be closed just north of Cypress Drive and relocated to intersect with Greenbrook Parkway; and Homewood Place, Woodbine Place, Bridgewood Drive, and Lockwood Drive will be closed just north of their intersection with Charter Oak Drive. The closing of the streets and reuse of the right-of-way will be handled in a manner similar to the concept in Figure 6. Rustwood Drive will be closed just

GREENBROOK
SPECIAL TREATMENT AREA



The 220 homes in the Greenbrook Subdivision in Southaven, Mississippi, are grouped into a triangular shaped area bounded roughly by Charter Oak Drive*, northern Cypress Cove, and Greenbrook Lake on the south and west. It is also bounded by Stateline Road on the north and Swinnea Road on the east. The Lakeshore Townhomes are also part of this buyout area. Notice the remaining large area of blue surrounding this acquisition area. This includes rural homes eligible for acquisition.

*Does not include houses that face or are adjacent to this street.

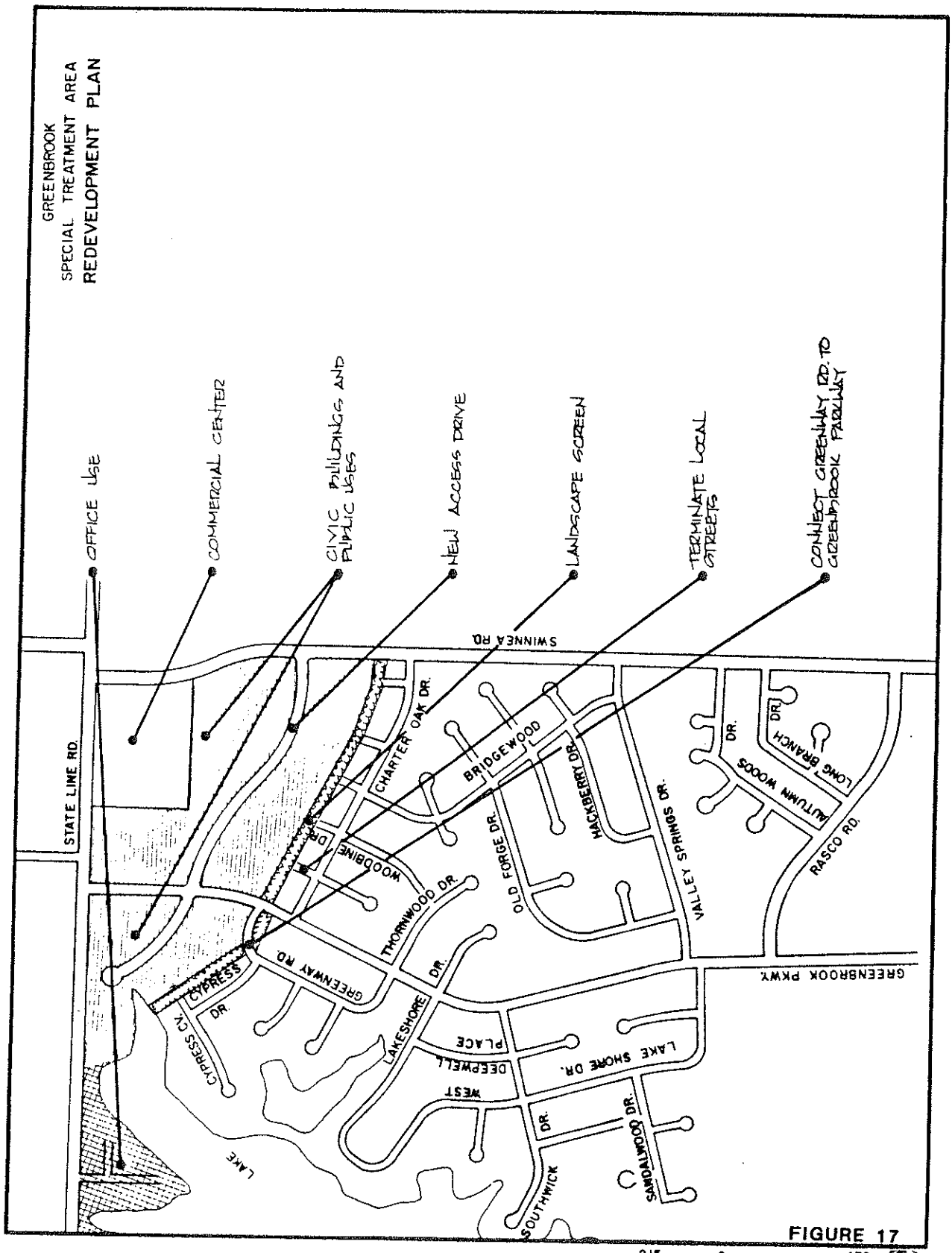


FIGURE 17

CITY of MEMPHIS / CITY of SOUTHAVEN / CITY of HORN LAKE / SHELBY COUNTY / DESOTO COUNTY / MEMPHIS and SHELBY COUNTY AIRPORT AUTHORITY

Barge Waggoner Sumner and Cannon

MEMPHIS AIRPORT AREA LAND USE STUDY

GREENBROOK SPECIAL TREATMENT AREA
REDEVELOPMENT PLAN

In association with GA PARTNERS [illegible] HARRIS MILLER MILLER & HANSON SIMON JACKSON & PARTN

north of its intersection with Charter Oak Drive and also with its intersection with Greenbrook Parkway.

5. A buffer strip similar to the concept shown in Figure 7 will be provided adjacent to all residential areas that will abut the public-use facilities to be developed in the buyout area.

6. A commercially zoned lot currently exists and will remain at the southwest corner of State Line Road and Swinnea Road.

7. All access to the site will be provided from a collector road connecting with Greenbrook Parkway or Swinnea Road as shown in Figure 17. There will be no access to the site from the Greenbrook Subdivision other than along Greenbrook Parkway.

8. The land north of the Greenbrook buyout area between State Line Road and the Tennessee/Mississippi state line is also designated for public use.

9. The townhouses on Danforth Lane and Woodshire Road are designated for redevelopment to office use.

OAKHAVEN

The Oakhaven STA is bordered by the airport on both the north and west; it is situated inside the inverted "L" shape created by the east/west and north/south airport runway configuration (see Figure 18). Prescott and Tchulahoma form the eastern boundary of Oakhaven, while Arnold Road and Shelby Drive delineate the southern edge. The developed portions of the Oakhaven STA are composed almost entirely of residential land uses and neighborhood-related community facility development. There is a substantial amount of vacant land in the area, including a large area along the Hurricane Creek boundary of the airport and another large tract between Tchulahoma and Prescott. An industrial distribution park is being developed on the Tchulahoma/Prescott property. The residential properties east and west of Nancy Road have recently been included in an airport acquisition program.

The following guidelines are recommended for Oakhaven:

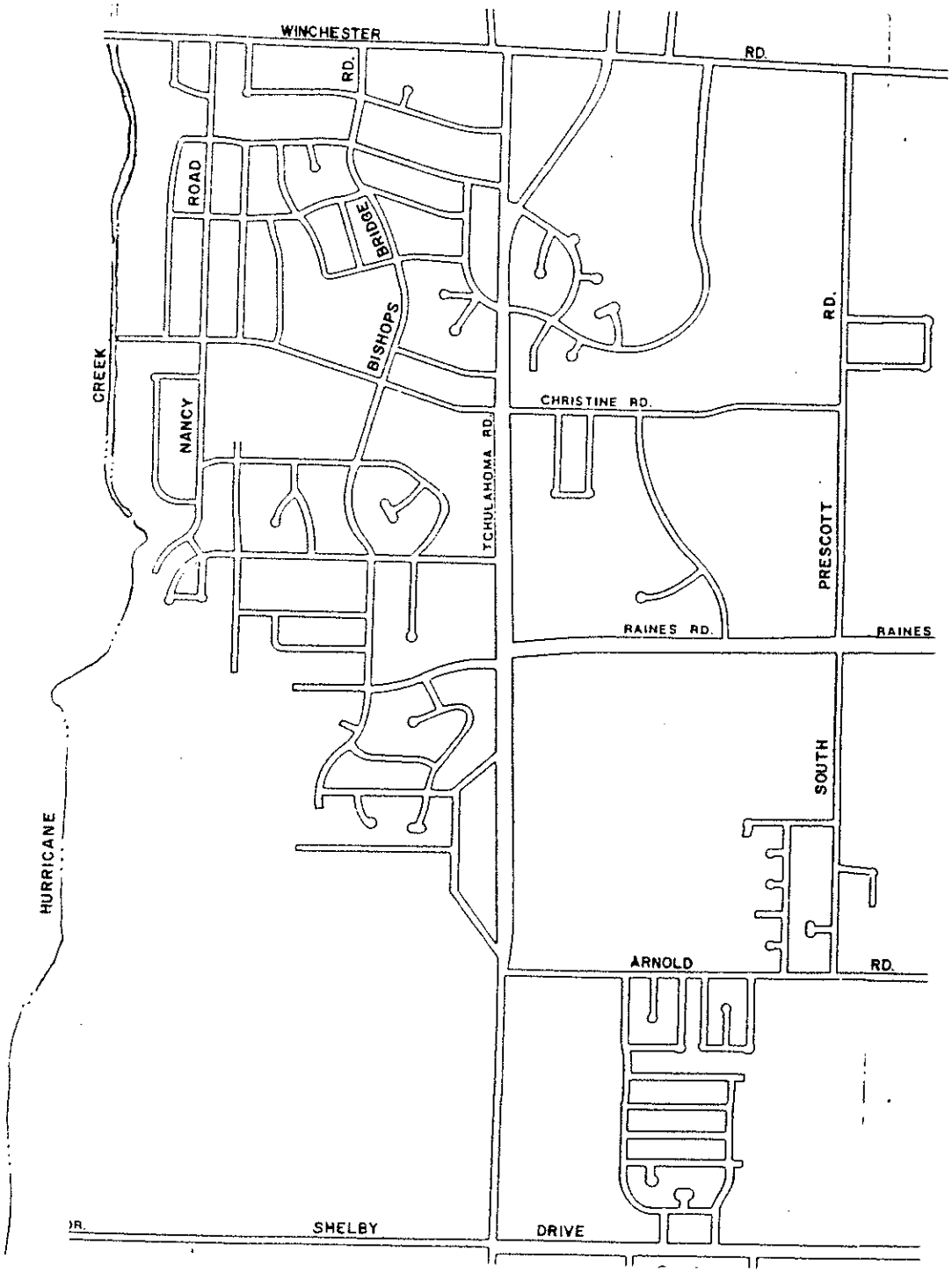
1. The existing Swinnea Road will be closed and relocated to the present location of Nancy Road. The property west of the new Swinnea/Nancy Road will be purchased for airport use (see Figure 19).

2. Patsy Road, Linda Road, Hemphill Road, Marjean Road--all west of Nancy Road--will be closed and the pavement eventually removed. The segments of Cromwell Road, Brenda Road, and Clarendon Road west of Nancy Road will also be closed.

3. To the east of the new Swinnea/Nancy Road, Oakhaven will remain as a residential neighborhood. No additional noise buyouts or airport expansion acquisitions are planned or anticipated by the Airport Authority. The new Swinnea Road and the buffer strip separating the airport uses from the neighborhood will help stabilize the area. A landscaped berm area will be provided between the neighborhood and Swinnea Road, similar to the concept in Figure 7.

4. The local residential roads of Cromwell, Clarendon, Christine, Beauchamp, and Queensgate will be closed at their intersection with New Swinnea.

OAKHAVEN
SPECIAL TREATMENT AREA



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MEMPHIS AIRPORT AREA LAND USE STUDY

FIGURE 18

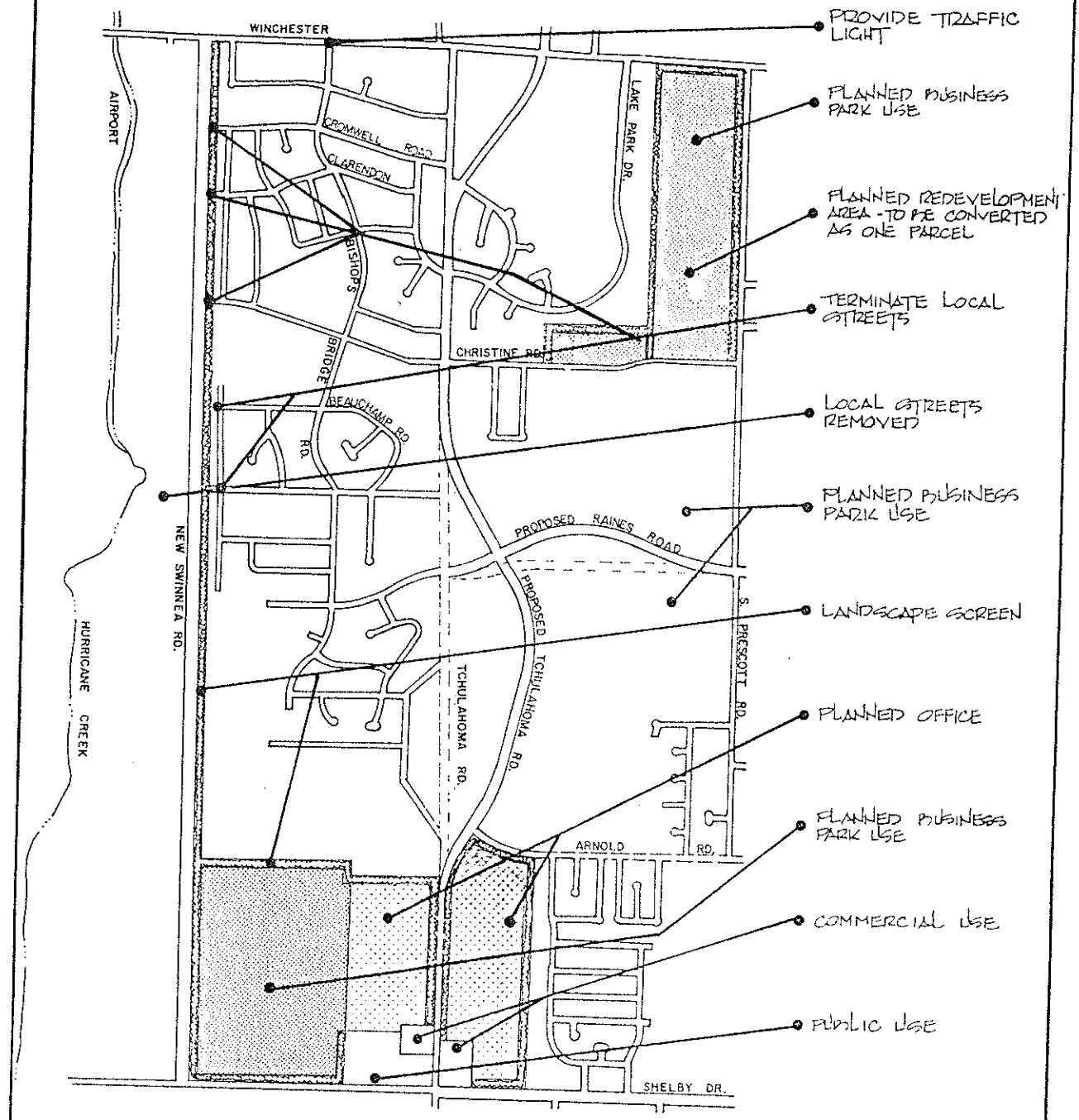

FIGURE 19

600 300 0 600 1200
SCALE 1"=1200'

CITY of MEMPHIS / CITY of SOUTHAVEN / CITY of HORN LAKE / SHELBY COUNTY / DESOTO COUNTY / MEMPHIS and SHELBY COUNTY AIRPORT AUTHORITY

Barge Waggoner Sumner and Cannon

MEMPHIS AIRPORT AREA LAND USE STUDY

OAKHAVEN LAND USE CONCEPT

In association with GA PARTNERS GILMORE INC. - HARRIS MILLER MILLER & HANSON - SIMON LARSON & PURDY

5. A traffic light will be provided at the intersection of Winchester and Bishops Bridge Roads.

6. Raines Road, between Tchulahoma and Swinnea, will not be extended to Swinnea.

7. An extension of the planned business park area is designated for the area east of Tchulahoma, north of Arnold, west of Prescott, and north of Christine (see Figure 19). This area will be designated for planned business park use, requiring landscaping, buffering, and site plan review for each site when rezoned and developed. The southeast corner of Arnold and Tchulahoma is designated for low-density office use to be compatible with surrounding residential uses.

Cost estimates for redevelopment of the buyout areas have been determined and are shown in Table 3.

IMPLICATIONS FOR DEVELOPMENT IN OTHER SUBMARKETS

The development trends anticipated in the vicinity of the airport are not expected to substantially alter recent industrial and warehouse/distribution space development patterns in the region.

They are also not expected to change the regional office and retail space development trends exhibited during the last decade. A detailed review of regional submarkets was carried out in the Inventory and Analysis Report. In summary, it is expected that downtown/midtown development will continue to have heavy competition due to extensive development in the city's suburbs. This is a trend that is expected to continue for the near future. However, downtown revitalization as a residential and cultural center will continue, and an increase in recreation and tourist activity is projected. Expansion of the airport and the associated increase in development activity in the airport area is not expected to change the character of downtown Memphis. The downtown/midtown area should remain the focus of government, business, financial, medical, and tourist activity in the region.

The East Memphis/Germantown area will continue to be the prime location for Class A office growth, which will continue to fuel retail demand. Increased employment will encourage additional residential development. The Nonconnah Parkway area is expected to continue to grow, with continued office, retail, and industrial activity related to the construction of the new roadway and the close proximity to the airport.

The Raleigh/Bartlett area is expected to have continued residential and retail expansion, with moderate industrial and office development. The Southaven/Horn Lake area is expected to continue to grow as a residential center, which will expand retail support activity. Warehouse and distribution space is projected to increase to serve the Memphis International Airport. Both Raleigh/Bartlett and Southaven/Horn Lake are expected to grow and continue to mature as major suburban markets.

Airport expansion and redevelopment of the buyout areas near the airport are not expected to negatively impact the development activities of the other regional submarkets. Because of the independent nature of each of the submarkets, they are expected to continue to follow the current trends. Airport expansion will help increase activity in the Nonconnah Parkway and Southaven/Horn Lake submarkets.

SPECIAL TREATMENT AREA REDEVELOPMENT PLAN — COST ESTIMATES — TABLE 3

ITEM	DESCRIPTION	WHITEHAVEN AREA				CHARJEAN AREA	GREEN-BROOK AREA	OAK HAVEN AREA
		WINCHESTER RD TO FEDERAL EXPRESS	FEDERAL EXPRESS TO SHELBY DRIVE	SHELBY DRIVE TO HOLMES RD.	HOLMES RD. TO STATE LINE RD.			
1	ADDITIONAL LAND ACQUISITION	-	-	-	-	$3,000,000	-	-
2	REMOVAL OF EXISTING STREET AND UTILITIES	$1,000,000	$550,000	$105,000	$280,000	$800,000	$700,000	-
3	MAJOR COLLECTOR STREET	-	-	-	-	$1,620,000	-	-
4	LOCAL COLLECTOR STREET	$350,000	$1,050,000	$335,000	$590,000	$410,000	$280,000	-
5	MINOR LOCAL STREET	$460,000	-	-	-	$160,000	$92,000	-
6	SEWER LINES	$123,000	$115,000	$40,000	$63,000	$203,000	$45,000	-
7	DRAINAGE IMPROVEMENTS	$275,000	$250,000	$80,000	$140,000	$400,000	$68,000	-
8	GAS & WATER EXTENSION	$150,000	$130,000	$14,000	$70,000	$227,000	$50,000	-
9	LANDSCAPING SCREEN	$57,000	$80,000	$36,000	$41,000	-	-	-
10	LANDSCAPING SCREEN WITH BERM	$90,000	$300,000	$120,000	$126,000	$420,000	$100,000	-
	TOTAL	$2,505,000	$2,475,000	$730,000	$1,310,000	$7,240,000	$1,335,000	

TABLE 3

MAINTAINING NEIGHBORHOOD STABILITY/GUIDELINES

The Greater Memphis metropolitan complex, like all urban areas, is a dynamic entity. The interaction of social, economic, and physical forces results in constant change and adaptation of the community. The land use planning program addresses the physical ramifications of the dynamic urban process. Social, economic, and many physical factors other than use of land help shape the plan's recommendations.

Over time, subareas in the urbanized community exist in one of three general conditions: growth, maintenance, or deterioration. Because of the stimulus of economic factors, growth in the community occurs constantly. The land use planning program strives to channel and direct the location of growth (land development projects) to achieve a sound community structure.

Existing developed areas located outside the thrust of growth pressures must be actively maintained to retain their continuing state of stability. Maintenance of stable conditions must be a conscious effort undertaken by property owners and local government. For developed properties not in growth or maintenance areas, a slow rate of deterioration is likely to occur. Through the lack of maintenance and economic stimulus for change, properties in these areas tend to fall into a state of disrepair, thus fueling their continuing economic decline.

The depiction of urban communities consisting of three types of areas--growth, maintenance, and deterioration--is a simplified model. The three conditions can also be viewed as three places on a continuum where groups of properties and neighborhoods can move in time from one condition to another as a result of many different factors. For example, after initial development of an area--the growth stage--the area is likely to function for an extended period providing uses that were intended during the initial construction. As buildings age and become economically obsolete or as other factors occur, such as high traffic volumes and increased aircraft noise levels, the owner/investor's interest in the property can decline and the area can start to move toward the deterioration stage. Movement from "stable" to "deterioration" need not, however, be a one-way trip. Through concerted action, a community can reverse the trend and return the area to a stable or growth stage.

In neighborhoods surrounding the Memphis Airport, land areas exist in several of the land development stages. The buyout properties are examples of areas where public funds are being spent to rebuild former stable residential properties with alternative land uses that will not be adversely affected by high noise levels that contributed to the decline of the residential uses. Other residential, commercial, and industrial areas in the study area clearly exist in a stable condition where their intended functions are performed in well-maintained settings.

Finally, other residential areas, while appearing to be sound, stable areas, are beginning to show signs of sliding out of the maintenance or stable category. The Oakhaven, Whitehaven (east of I-55), and Greenbrook neighborhoods have subareas where these symptoms have been observed.

Within residential neighborhoods, a sense of stability or equilibrium is an important ingredient in the way property is used, as well as in the quality of life experienced by residents. When the sense of stability or equilibrium is disrupted, the quality of life deteriorates and the function of a physically sound area can begin to deteriorate.

In parts of Oakhaven, Whitehaven, and Greenbrook, the sense of community stability has weakened. One symptom of the unsettled condition is the real or perceived decline in residential real estate values and the resulting slowdown in market transactions in neighborhoods containing and adjoining the Airport Authority's buyout program. The

Authority's decision to solve intolerably high noise-level problems for residents living in the buyout areas has met the needs of the affected owners, but disrupted the equilibrium of areas adjoining the acquired properties.

The disruption of equilibrium has resulted from the residents' perception of illogical boundary lines that define the buyout areas from otherwise sound functioning neighborhoods. The perception of property owners in areas adjacent to the buyout areas is that aircraft noise is as disruptive to their property as to their neighbor's property located in the buyout areas. It is the FAA policy to buy property in the 75-L_{dn} noise area. While the Authority's definition of the buyout area is based on the best available scientific information and land management decisions, the net effect of the buyout program is to disrupt the adjoining residential neighborhoods.

To the extent practical, the contribution of the land use plan to long-term occupancy of existing neighborhoods in the study area will be to devise ways to contribute to the restoration of stability and equilibrium in these areas.

In structuring a program to address the needs of existing residents living in sound and physically stable neighborhoods, the following guidelines have been developed.

1. Given the existing and likely future resources available to the Airport Authority and local governments, it is impractical to assume that all residential structures located in the Charjean, Oakhaven, Whitehaven (between Airways and I-55), and Greenbrook areas can be acquired.

   The present buyout program anticipates eventually spending $120 million for the acquisition of residential and church property in the present buyout area. To include all of Oakhaven, Charjean, Whitehaven east of I-55, and Greenbrook north of Rasco Road, the program would require a multifold expansion. The solution to the airport noise intrusion problem is not to purchase all noise-affected residential properties with public funds.

2. Even as the equilibrium in the residential areas has been disrupted through actions of the Airport Authority to solve its worst case problems, equilibrium can be restored in part through a cooperative effort by the Authority and local governments to help stabilize residential neighborhoods. Commitment to a long-term land use program supported by adoption and administration of effective zoning regulations, building codes, and a community facilities program will contribute to community stability.

3. Direct actions taken to mitigate aircraft noise intrusion into existing residential areas must be studied and appropriate actions taken. A range of actions that may produce positive benefits includes coordination of take-off and landing procedures to better fit the community's land use structure, construction of noise attenuation structures to reduce the "line of site" noise created by ground-operated aircraft, and introduction of soundproofing materials into existing residences.

4. Given the structure of enabling legislation in Tennessee, an opportunity to create a partially self-funded program to help mitigate aircraft noise problems should be explored by local government and the Airport Authority. The program can utilize redevelopment legislation and funding options such as tax increment financing techniques. While funds derived from the program will not permit wholesale acquisition of all residential areas as desired by some residents, it can broaden the pool of funds available to address noise problems.

5. Existing stable residential areas will be protected from construction of new disruptive land uses, such as incompatible higher-density residential structures and

encroaching commercial and industrial uses. When construction of potentially disruptive uses is permitted, use of screening/buffering zones, expanded setback of buildings, limited building height, limited intrusion from outdoor lights, and directing of traffic away from residential areas should be considered as techniques to mitigate the disruption.

6. Routine maintenance by private property owners is encouraged, and the overall condition of the property should be upgraded when necessary to preserve stable development and help restore positive property owner attitudes about the area.

7. Vacant land or isolated, vacant lots located in a stable area, or presently occupied land to be redeveloped should be utilized for residential, public, or semipublic development. Land located adjacent to stable areas and in a buyout area should be used for purposes shown in the land use plan.

8. Densities of new residential development will be compatible with the density of surrounding residential areas, and a buffer will be provided when there is a significant difference in densities. Reuse of existing residential structures will be designed to occur at a density compatible with surrounding structures.

9. Proposed residential development which has a significantly different size, height, or mass from adjacent existing development will be discouraged if the differences detract from the use and privacy of the existing development.

10. Existing commercial uses and other uses incompatible with the residential character of stable areas will be encouraged to:

    a. Protect adjoining residential properties by construction and maintenance of planting screens, attractive walls, earthen mounds, and/or other appropriate buffering devices.

    b. Provide safe, attractive pedestrian walks and entrances to business uses.

    c. Avoid the construction of parking lots that will result in the removal of residential structures that contribute to the scale and character of the residential area. If new or expanded parking lots are built, adequate screening will be provided to protect adjoining residential uses.

    d. Expand building space for commercial or other incompatible uses only if the additional space does not detract from the established residential character.

    e. Control outdoor lighting, sound, and signs to avoid disrupting the use of adjacent residential properties.

11. Maintenance and improvements to the public infrastructure should receive the attention necessary to help maintain the stable areas.

NOISE ANALYSIS/GUIDELINES

The land use plan has been developed using aircraft noise as one of several determinants of the pattern of proposed land uses. Noise exposure can be objectively quantified with noise contours, and specific development limitations and requirements may be imposed using the contours as a basis for determining noise problems. This section discusses implementation of specific noise-based requirements and presents implementation issues that jurisdictions should consider as they turn the land use plan into reality.

The following paragraphs address additional constraints on residential development, use of noise-based building codes, and use of noise barriers. A final subsection presents a discussion of noise contours, how they should be used, and how they should be developed to implement these restrictions.

ADDITIONAL CONSTRAINTS ON RESIDENTIAL DEVELOPMENT

The community's adopted zoning regulations identify where residential development may occur. Some residential areas will be exposed to aircraft noise, and the building code provisions discussed below seek to provide acceptable interior noise levels by requiring adequate sound insulation in new construction. However, building codes obviously provide no noise-reduction benefits to noise-sensitive outdoor activities. Jurisdictions should consider additional constraints on uses that have this type of outdoor activity, primarily residential development.

A very protective approach would be to prohibit any residential development that includes significant outdoor activity within areas exposed to levels of noise exceeding 65 L_{dn}. California and Maryland generally take this approach, although most state and federal guidelines permit some residential uses to be exposed to noise in the 65- to 75-L_{dn} range if appropriate sound insulation is included in the buildings. However, the aircraft noise exposure produced by operations at Memphis Airport is different from noise around most other airports. Memphis is significantly affected by nighttime jet aircraft operations. Consequently, application of "standard" noise and land use compatibility guidelines to local conditions must be reevaluated.

A variation of the standard guidelines is suggested for consideration by local jurisdictions. For jurisdictions wishing to provide a higher degree of land use/noise compatibility and where such land use constraints are deemed feasible, noise contours computed by excluding all nighttime cargo operations could be used to limit residential development.

Standard guidelines are based on years of data collected at airports around the world. It is likely that most airports have far fewer nighttime operations than does Memphis, and that the assumption implicit in standard guidelines includes less noise produced during the nighttime. Thus, noise contours that do not include nighttime cargo operations are more comparable to the noise contours typically used to identify compatible land use patterns.

In essence, by excluding nighttime cargo operations, the contours more closely reflect the daytime noise exposure around the Memphis Airport. It is the daytime noise that additional restrictions are intended to address since outdoor residential space is more commonly used in the daytime hours than during the early morning hours (when most cargo operations occur).

Building code restrictions based on contours that include all aircraft operations provide acceptable indoor environments for both daytime activities and sleeping. However, building codes do not protect outdoor activities. Hence, by prohibiting residences from

locating within the non-nighttime cargo 65-L_{dn} contour, a jurisdiction will have protected outdoor residential activities from high daytime noise exposure.

If such an approach is taken to controlling development, reliable and up-to-date contours calculated both with and without nighttime cargo flights are a necessity. As the tempo of operations at the airport changes, as new aircraft use the airport, as airport developments occur, and as the use of airspace is altered, noise exposure will change and the need to develop revised contours will arise. Consequently, an important part of this program to control land use through noise contours will be the accurate production and revision of the contours. These issues of contour production and revision are discussed below in the "Noise Contours" section.

Building code variance procedures should also be considered. Under certain conditions, there can be reasonable justification for permitting residential construction within the ordinarily prohibited area. Building a new house on a single lot that is surrounded by previously constructed houses, or "in-fill construction," could be a situation most jurisdictions would want to permit. Also, renovations and additions to existing residential houses may be acceptable to a jurisdiction, even though the buildings lie within the 65-L_{dn} significant-noise area.

NOISE-BASED BUILDING CODE PROVISIONS

Building code provisions can be used to provide acceptable indoor noise environments. In the Inventory and Analysis Report, indoor sound level criteria were provided, and building sound-level reductions that meet these criteria were developed. Table 4 repeats the indoor criteria, and the footnotes briefly describe the effects on activities if these maximum criteria are not exceeded. Table 5 gives maximum outdoor aircraft noise levels that are likely to occur at various levels of L_{dn}. These maximum levels were derived from noise measurements made at Memphis Airport[1]. Comparing these maximums to the indoor criteria gives the required sound level reductions presented in Table 6.

Building code provisions can ensure that minimum sound level reductions are provided by defining regulations in one of two ways. First, by specifying minimum performance standards for buildings or for building elements, registered architects and engineers will be able to design buildings that conform. Second, a set of design specifications that will provide the required sound-level reductions can be prepared for buildings where professional architects or engineers are not involved. Appendix B provides examples of these two approaches.

When building code requirements are developed, the following guidelines should be considered.

1. For structures that require design responsibility by registered architects or engineers, the amendment package should specify minimum performance standards that will permit qualified professional designers to achieve the noise control results by using different building design solutions.

2. For structures that do not require design participation by registered architects or engineers, a "user friendly" amendment package for the building code that will permit easy interpretation by building officials and property owners/ developers/contractors should be prepared.

3. The amendments should address the noise-reduction requirements for buildings of public use--offices, hospitals, schools, etc.

TABLE 4

INDOOR SOUND LEVEL CRITERIA[1]

Building Type	Maximum Interior Level (dBA)
Hospitals	40-45[a]
Residential	50-55[b]
Schools	55-60[c]
Offices	60-65[d]

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[1] Noise Study for the Master Plan and Noise Compatibility Program for Memphis Airport, Wyle Research Report, WR 85-5, March 1985.

[a] Only a small percentage of people, less than 5%, are likely to be awakened by these maximum levels, J. S. Newman and K. R. Beattie, "Aviation Noise Effects," U.S. Department of Transportation Report No. FAA-EE-85-2 (March 1985), pp. 55-57.

[b] Less than 15% of the people exposed to these maximum levels are likely to be awakened, Ibid, pp. 56-57.

[c] These maximums will still permit satisfactory communication at distances up to 12 to 18 feet with raised voice. It should be noted that these disruptions will also be brief (probably less than 15 seconds per overflight).

[d] Keeping noise intrusions below the maximum should maintain acceptable speech communication with normal voice levels at a distance of 3 feet and should provide satisfactory to slightly difficult telephone use, Ibid, pp. 46-47.

TABLE 5

MAXIMUM OUTDOOR AIRCRAFT DEPARTURE NOISE LEVELS BY L_{dn} RANGE

	Day-Night Average Sound Level, dB		
	60-65	65-70	70-75
Maximum Exterior Aircraft Levels (dBA)	80-85	85-90	90-95

TABLE 6

SOUND LEVEL REDUCTIONS REQUIRED BY BUILDING TYPE FOR L_{dn} RANGE

Building Type	Max. Interior Level (dBA)	Required Sound Level Reductions by Day-Night Average Sound Level, dB		
		60-65	65-70	70-75
Hospitals	40-45	40	45	50
Residential	50-55	30	35	40
Schools	55-60	25	30	35
Offices	60-65	20	25	30

4. The amendments should address noise-reduction requirements for residential structures by considering design requirements for walls, windows, doors, roofs, ceilings, floors, and ventilation systems.

NOISE BARRIERS

Noise barriers can reduce the noise produced by aircraft on the ground. Hence they may be beneficial for noise-sensitive areas where the predominant noise sources are aircraft beginning takeoff, using reverse thrust after landing, taxiing, and running engines while on the ground. For Memphis Airport, areas directly east or west of runways 18/36--the primary north/south runways--are exposed primarily to this type of noise. Barriers properly designed and located are likely to provide noticeable noise reduction for these areas, such as Oakhaven and the Airways Road corridor in Whitehaven.

These areas, however, are essentially fully developed, and interactions between noise barrier construction and building construction are not likely to be an issue. For example, if there existed large undeveloped tracts to the east or west of the airport, a developer might well find an economic incentive in constructing a noise barrier if it meant less sound insulation in buildings would be required. Noise barriers, however, are recommended for consideration as part of the Community Stabilization Plan and are discussed in that context under the Implementation Plan.

NOISE CONTOURS

Noise contours will form the basis for determining the areas affected by the specific land use restrictions and by the building code provisions. Such use of contours is common, but the process requires that the contours be applied in a specific, consistent manner. The contour location will determine what uses may be made of the land and what construction standards (sound insulation details) will be used. These determinations have cost implications for the building industry and thus are subject to scrutiny and challenge. Hence, the program must have a consistent approach for contour development, application, and revision.

Once a contouring procedure is developed, it should be documented in a way that permits consistent revision over the years. Revisions are discussed in more detail below, but it is important that noise contours not change simply because a different method has been used to produce them; changes in contours from year to year should reflect real changes in noise exposure, and not merely changes in the contour development method. Naturally, if improved methods of contour calculation become available, they should be considered for use. As technology changes, more accurate methods for contour development are likely. The objective of contour computation should be to produce the most accurate contours feasible, given the state of the art. Thus, as new versions of the INM or the noise data base become available, they should be tried and used if feasible. The subsection below discusses the process of contour revision.

Application. The location of contours relative to a parcel of land determines development constraints and building code requirements for the parcel. A simple procedure for applying noise contours to land parcels is suggested.

1. Compute and draw the 60, 65, 70, and 75-L_{dn} contours.

2. For parcels not touched by a contour line but falling between two of the contours, apply the criteria for that range; e.g., apply the building code for the 60- to 65-L_{dn} range for parcels between the 60 and 65-L_{dn} contours.

3. For parcels that are touched by a contour, apply the criteria for the more restrictive range; e.g., for a parcel touched by the 65-L_{dn} contour, apply the criteria for the 65- to 70-L_{dn} range.

Revision. Once land use and building code provisions are tied to contours, revisions will affect the application of these provisions. Consequently, on the one hand, revisions should not be made for minor changes in noise exposure; but on the other hand, changes in airport/airspace operations that result in significant changes in exposure should be carefully considered and evaluated before implementation.

The Federal Aviation Administration has identified an increase in Day Night Sound Level of 1.5 dB or greater as a threshold of significant change. First, Federal Aviation Regulation Part 150, Section 150.21(d), requires revision of the noise exposure map (noise contours and land use map) if a change in operation of an airport results in a 1.5 dB increase in either new or previously existing noncompatible areas. Also, FAA Order 1050.1D, Policies and Procedures for Considering Environmental Impacts, requires detailed analysis of actions that result in an increase within the 65-L_{dn} contour of 1.5 dB or more in a noise-sensitive area. Since the building code provisions are based on noise exposure levels of 60 L_{dn} and above, a reasonable approach is to develop a detailed analysis of actions that result in a 1.5 dB increase in any noise-sensitive area within the 60-L_{dn} contour.

Thus jurisdictions that base land use restrictions and building code provisions on noise exposure contours should take part in the noise exposure map revision process. They should have an opportunity to provide information to the Airport Authority concerning the likely effects of noise contour changes on planning and land use controls and, thus, help in the development and acceptance of changes at the airport.

RECENT NOISE LEGISLATION

On October 27, Congress passed a landmark bill setting the framework for a national noise policy. The bill came about as the result of a recognized need by airport operators, airlines, air cargo airlines, and pilots for nationwide standards for noise. The two main issues of the bill are the Passenger Facility Charge (PFC) and the phase-out of Stage II aircraft by the end of 1999.

In addition, the Aviation Trust Fund was increased from $1.42 billion in FY 90 to $1.8 billion in FY 91, and $1.9 billion in FY 92.

The following highlight the provisions of the bill:

1. Passenger Facility Charge. A fee of $1, $2, or $3 may be imposed by air carrier airports on enplaning, originating, and connecting passengers. The revenue from this charge must be used at that airport for expansion and noise compatibility projects. Use of this fee will reduce an airport's guaranteed entitlements from the FAA by 50 percent, and that money would go to airports who do not have the ability to levy PFCs. The Department of Transportation (DOT) Secretary must develop rules for PFC implementation within 180 days.

2. Phaseout of Stage II Aircraft. Airlines will be required under this legislation to phase out 85 percent of their Stage II fleet (about 2,000 aircraft) by December 31, 1999. The remaining 15 percent can operate under a waiver until December 31, 2003. In addition, no European Stage II aircraft can be imported into the United States unless it is under written contract to a U.S. carrier before the date of enactment of the legislation or modified to meet Stage III noise standards.

3. DOT Review of Noise Rules. DOT must establish a federal program for reviewing airport noise and access restrictions on both Stage II and Stage III aircraft. This noise policy must be in place by July 1, 1991.

4. Review of Stage III Restrictions. Any proposed restriction initiated after October 1, 1990, on a Stage III aircraft must be reviewed by the DOT for approval. The federal government will assume liability for noise damages, based on a constitutional "taking" of property that directly results from the Secretary's disapproval of an airport's proposed Stage III restriction.

IMPLEMENTATION PROGRAM

The land use planning program has been defined to direct the location of new development, rebuild the buyout areas, and promote stability of existing areas by discouraging deterioration in segments of the community. To achieve these goals, a three-part implementation strategy has been devised. The strategy consists of **zoning actions**, amendments to the **building codes**, and a **redevelopment program**. A framework for undertaking actions in each of these four areas is described in the following section.

ZONING ACTIONS

Local zoning regulations are primarily directed at controlling land use and its intensity, by classifying individual properties into one of a number of zoning districts. The basic rules for each district described in the regulation provide for uniform treatment of all properties located within that district. In addition, zoning regulations typically control additional features of development on the property, such as minimum yard size requirements, limits on the height and floor area of buildings, requirements of a particular number of off-street parking spaces, limits on the size and number of signs on the property, and landscaping requirements. The adopted framework which each community sets out in its zoning regulations thus defines the collection of compatible uses within each individual zoning district. The property owner can use the property in the manner allowed under the regulations for the appropriate zoning district.

Local zoning regulations entail a number of different actions by the local government. For example, the local government must decide what types of districts it wishes to set up in the community, reflecting both the existing character of the community and its plans and goals for future development. The local government must also decide which properties will be classified into which districts. Beyond this, there are a number of other actions which may be taken, such as granting a property owner's request for "rezoning" his or her property to a different district, or granting a property owner's request for a "variance" from a particular regulation because of some undue hardship that the regulation imposes for the use and enjoyment of the property.

Based on the results of this land use study, three types of zoning actions will be needed in order to implement the recommended plan. First, the local governments in the study area will need to add new zoning districts to their zoning regulations to accommodate and ensure the types of development which the plan recommends. Second, the local governments in the study area will need to rezone a number of properties into zoning districts that are different from their current zoning to permit development of those properties in ways that are consistent with the recommended plan. Third, at least in Memphis and Shelby County, some new procedures will need to be incorporated into the local zoning regulations in order to better control the granting of "use variances," which have the potential of undermining the recommended plan.

New Zoning Districts: Planned Office Park and Planned Business Park

The first type of zoning action which local governments in the study area will need to take is the formulation and adoption of one or two new zoning districts which correspond to two of the land use classifications set out in the recommended plan--"planned office park" and "planned business park."

As explained below in more detail, rezoning actions will be an important element of the plan's implementation program. Where a land use in the recommended plan varies from the current zoning of a particular property, the zoning of that property will at some point

need to be changed to accommodate the recommended use. In most cases, this can be accomplished by rezoning the property to another zoning district already appearing in the community's zoning ordinance.

Planned Employment Centers

Throughout the nation, there is a definite and steady trend for the market to provide industrial and office space in a business park environment. This trend has developed for a variety of reasons, such as structural changes in the economy which reflect a continuing shift from traditional manufacturing and "smokestack" industries to high-tech and service industries. This trend has manifested itself in the form of more flexible and higher-quality buildings and the provision of more amenities. The reduced need for warehouse space, the increased need for office space, and the feasibility and continuing desirability of integrating many high-technology industries with light manufacturing, laboratory, and/or testing facilities have all combined to breed a new type of building and a new type of industrial area. Furthermore, an increasing demand for pleasant, high-quality settings that enhance the image of a business and provide amenities that make it a desirable place to work (e.g., landscaping, fitness centers, and restaurants) has resulted in new business parks being designed in a campus-like setting.

Such business parks are characterized by high-quality architecture, usually resembling suburban office buildings, with large amounts of landscaped areas, often with water features and separate pedestrian circulation systems. Special efforts are usually undertaken to ensure that loading, trash removal, and other unattractive but necessary uses are out of view of roads, adjacent residential areas, and other buildings within the park. Extensive landscaping, berms, buffers, and sensitive environmental designs also are commonly included in this new type of business park.

Zoning ordinances across the nation are being revamped to accommodate this new type of land use. Zoning for such business parks typically gets away from the traditional "Euclidian" approach, in which different types of uses (e.g., offices, restaurants, and industry) are strictly segregated so that an appropriate mix of uses can occur in the campus-like setting. The new regulations often use performance standards to allow more flexibility in the design, development, and leasing of the project. Planned development designations typically allow local government to impose additional requirements specific to individual projects (landscaping, screening, separation of delivery truck/automobile circulation systems, etc.) as part of the development approval process.

However, the planned business park and planned office park designations appearing in the recommended plan do not directly correspond to any of the current zoning districts adopted by communities in the study area. While each community's zoning ordinance now contains planned development (PD), planned unit development (PUD), and/or planned commercial provisions that might accommodate such development, it may be more effective for each community to have a zoning district designation and corresponding regulations which directly focus on the type of development envisioned by the recommended planned business park and planned office park designations.

The regulations contained in existing commercial, office, and industrial districts do not adequately provide for the environment proposed for the business or office park. Likewise, PDs or PUDs are often too general to accommodate concerns of adjacent land owners.

The new planned business park and planned office park districts will each have a narrow and clearly defined range of allowable uses, as well as better defined parameters and requirements for building height, total floor area, and landscaping, than those appearing in each community's existing planned development, planned unit development, or zoning

provisions. Furthermore, these new districts could either be premapped or await the property owner's coming forward to request the zoning.

The legal underpinning for planned development districts are as sound as the legal underpinnings for any other type of zoning district. Such a district is likely to rely on a detailed, multistep site plan review and approval process, as well as a system of performance standards to ensure a higher quality of development and its compatibility with adjacent land uses. These methods of regulation, if properly crafted, are legally sound and acceptable.

The planned business park and planned office park designations on the recommended plan are intended to be such districts. The principal difference between the planned business park district and the planned office park district will most likely be in the range of uses that are allowed in each. The planned office park district will not be as likely as the planned business park to include manufacturing and research uses. Outside of this difference, the regulations governing landscaping, building bulk, and other physical features of development within the two districts will probably be similar, except that the quality of site development will be somewhat higher in the planned office park district. Care will also be taken to ensure higher quality standards for development located in proximity to residential uses.

The actual regulations for each district, as well as the general outline of the district regulations, are likely to vary from community to community based on (1) the particular desires and character of each community in the study area and (2) the overall format of each community's existing zoning ordinance. The regulations should be drafted so that they will be an integral part of, and consistent with, the remainder of the zoning ordinance.

Rezoning of Properties

In addition to the adoption of these two new zoning districts, the rezoning of properties will be an important element of the implementation program. Where the recommended land use varies from the current zoning of a particular vacant tract, the zoning of that property will at some point need to be changed.

Memphis/Shelby County

A comparison of the land use designations in the recommended plan to the Memphis/Shelby County Zoning Atlas reveals that implementation of the plan will require the rezoning of many properties, primarily in the Whitehaven/Airways Road, Oakhaven, and Charjean areas. These rezoning actions generally will involve (1) the rezoning of large portions of the Charjean area from residential to planned business park; (2) the rezoning of the west side of Airways Road (between Winchester Road and the state line) from a mix of residential and commercial to planned office park; and (3) the rezoning of most of the undeveloped lands in the Oakhaven area from a mix of residential and commercial to planned business park. Another major rezoning action will be to rezone the bulk of the land in the study area southeast of the airport to planned business park. The Zoning Atlas now classifies those properties into a mix of residential, commercial, and agricultural districts. In addition, there are various smaller locations throughout the study area where the land use designation does not match the property's current zoning. In most instances, the mismatch will entail the rezoning of property from its current district classification to another district classification.

City of Southaven

Because all of the City of Southaven lies within the study area, the recommended plan carries the potential for having wide-ranging implications for the city's land use controls.

The types of rezoning actions which need to occur in Southaven to implement the recommended plan vary widely. In some areas, rezoning will accommodate land uses which are more intensive than the current zoning allows. For example, the area along State Line Road between Horn Lake Road and Tulane Road, which the plan designates as planned business park and industrial, is now zoned for agricultural use. Similarly, the area west of I-55 between Rasco Road and Goodman Road, as well as the area east of Swinnea Road and south of the state line, is designated in the plan as planned business park, but is currently zoned for residential use.

In other cases, the land use designation is for a less-intensive use than that allowed under the current zoning districts. For example, property west of Airways Road and north of Goodman Road is designated in the plan for commercial use, but is currently zoned to permit industrial use.

The vast majority of land use designations in the recommended plan could be accomplished by rezoning properties to other zoning district classifications now appearing in Southaven's zoning ordinance. The planned business park designation, however, does not correspond to any of the city's existing zoning districts. As a result, this new zoning district will need to be incorporated into the zoning ordinance.

City of Horn Lake

Like Southaven, the recommended plan for the City of Horn Lake has the potential for wide-ranging implications on land use controls because all of the City of Horn Lake lies within the study area.

Most significantly, the area south of Nail Road between Hurt Road and U.S. 51 will need to be rezoned from residential use to planned business park. Similarly, the area west of I-55 and south of Goodman Road will need to be rezoned from agricultural use to planned business park. In addition, the plan designates property north of Goodman Road and west of I-55 as commercial, which is now zoned for multifamily residential use. The plan also designates land east of Hurt Road between Goodman and Nail Roads as industrial, which is now zoned for agricultural use.

Many of the land use recommendations in the plan can be accomplished by rezoning the above-mentioned properties to other zoning district classifications now appearing in Horn Lake's zoning ordinance. The planned business park designation, however, must be added.

DeSoto County

The recommended plan's land use designations by and large conform to DeSoto County's existing zoning. Some rezoning will be needed, however, in order to implement the plan. Most significantly, the plan designates much of the land along State Line Road as planned business park, which is now zoned for agricultural and residential use. Properties to the west of I-55 and north of Church Road are designated planned business park, commercial, and office, but are currently zoned for planned unit development. Similarly, the plan designates land on the east side of I-55 for multifamily, office, and commercial uses, which is now zoned for planned unit development. The plan also designates some property along U.S. 51 at Nail Road as residential, which is now zoned for office and commercial use.

The land use designations in the recommended plan can largely be accomplished by rezoning the above-mentioned properties to other zoning district classifications now appearing in DeSoto County's zoning regulations. The planned business park designation, however, must be added to the regulations.

Controls Over Use Variances

Restrictions upon the discretion of the Memphis-Shelby County Board of Adjustment to grant "use variances" is the third type of zoning action that will need to be taken in Memphis and Shelby County. The continued granting of use variances in this area will have serious effects upon the purpose and intent of the recommended plan and the zoning regulations adopted.

Zoning regulations are complex and designed to apply to all property throughout the community. It is not feasible for a community to tailor separate zoning regulations for each individual parcel, even though each parcel of land is somewhat unique. As a result, when the requirements and limitations set forth in a zoning ordinance are applied across the board, some property owners may face a peculiar hardship. The unique conditions or circumstances of a particular piece of property may be such that strict application of the requirements and limitations set forth in the zoning ordinance will create an undue hardship or practical difficulties for the property owner in establishing and maintaining an allowable use of the property. Procedures for granting variances from zoning regulations exist to provide the flexibility needed to relieve such hardship, thus allowing the property owner to make some reasonably beneficial use of the property by providing individual relief from particular requirements or limitations in light of the unique circumstances or conditions of the property.

Variances can be classified into two different categories: "area" (bulk) variances and "use" variances. An area variance grants the property owner relief from a limitation or requirement regarding lot dimensions, minimum yards, and building height, or some other restriction on the bulk of a building. However, with such a variance, the property owner is still confined to the list of uses that the zoning ordinance allows for the zoning district in which the property is classified. An example of a bulk variance would be allowing someone to build a house within 10 feet of the side lot line when the ordinance requires a minimum side yard of 12 feet.

A use variance, on the other hand, has nothing to do with area restrictions. A use variance simply allows for departure from the restrictive list of uses for the zoning district so that the owner may establish a use on the property which is otherwise not allowed in that zoning district. An example of a use variance would be allowing someone to build a gas station on a property classified into an exclusively single-family residential zoning district. Use variances are much more troublesome than area variances because they have the effect of undermining the basic zoning plan for the community, which is based on the separation of different types of uses into different types of districts in order to avoid or minimize any incompatibilities between uses on neighboring properties. Indeed, the granting of a use variance is tantamount to a rezoning action because it allows the property owner to establish a use which is not allowed in the zoning district in which the property is classified.

The Memphis-Shelby County Zoning Ordinance-Regulations delegate the authority for granting variances to the Board of Adjustment. The overgenerous granting of use variances by the Board has been identified as a problem at least as early as the mid-1970s.[1]

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[1]See Johnson, "A Study of the Tennessee Public Acts and the Memphis and Shelby County Private Acts for Planning" (thesis for M.C.R.P. degree), at 81-95. The Board of Adjustment granted 80 use variances in 1979 alone. Johnson at 93. From 1974 to 1979, the Board of Adjustment granted an average of 79 use variances per year, representing about 80 percent of all applications for variances which were submitted. Johnson at 94. No similar data has been compiled and transmitted to us regarding the number of use variances granted in the past ten years.

The comprehensive revision of the zoning ordinance-regulations in the late 1970s attempted to restrict the Board of Adjustment's flexibility in granting use variances. However, recent concerns expressed by city and county officials indicate that this approach has not been effective. As a result, it may be useful to insert provisions into the zoning ordinance-regulations which further restrict the Board's ability to grant use variances and, thus, their ability (albeit unintentional) to defeat the intent and purpose of the recommended plan and the zoning changes made by the city and county to implement the plan. Such provisions should even go to the extent of totally prohibiting the Board from granting use variances.

Other Zoning Actions

Review and minor modification of other provisions in each community's zoning ordinance may also be required to help implement the recommended plan. For example, to ensure that new commercial development recommended by the plan is more compatible with abutting residential development, it may be appropriate to reassess any "buffering" requirements, if any, now enforced by the community to see if they are adequate.

There are a number of different ways of ensuring that different and incompatible types of development are adequately screened from view of each other. For example, there could be one prescribed combination of fencing and vegetation that applies to a wide range of land uses. Alternatively, the buffer regulations could be designed so that the developer has a choice from among different combinations of vegetation, fencing, berms, and/or setbacks which provide roughly the same screening effect between incompatible land uses. In addition, the degree of screening required could vary, depending on the level of incompatibility between different types of land uses. For example, heavier screening might be required between industrial uses and single-family residences than between apartment developments and single-family residences. The actual standards selected will depend, of course, on the character and desires of the individual community.

BUILDING CODES

During the preparation of the land use study, it was determined that the high noise levels generated by aircraft operating at the Memphis Airport have several components which require different remedial actions. **Sideline noise**, which occurs as a result of ground operations of aircraft, can be addressed most directly by the construction of berms and noise attenuation structures either close to the aircraft source of the noise or adjacent to the structures to be protected. Recommended activities to address sideline noise are contained in the acquisition area redevelopment strategy.

The second type of noise caused by **airborne aircraft** cannot be mitigated by noise attenuation structures. Such noise affecting the outdoor use of property can best be addressed by combining the management of land use patterns and directing the paths of aircraft operations away from sensitive land uses. Recommendations for coordinating aircraft operations and land use are also contained in the Community Stabilization portion of this strategy.

Airborne noise which affects indoor use of structures can best be addressed by amendments to the community's building codes. The approach to be followed in developing building code amendments will be to increase the noise-reduction requirements for structures as the level of airport noise measured by L_{dn} contours increases. This process results in the identification of several issues to be addressed during the preparation of the building code amendments.

Residential structures located outside the 65-L_{dn} contour may be adversely affected by nighttime noise generated by aircraft operations. Should the building code amendments

extend noise-reduction requirements beyond the last contour presently identified (65 L_{dn}) in the noise mitigation program? If so, how far should the noise contours be extended, and should the Airport Authority be encouraged to develop information to permit the location of the 65-L_{dn} contour? Expanding the noise-protection program outside the 60-L_{dn} contour will have an added advantage of adding a less restrictive set of building code requirements that may apply to land located between parts of the community clearly located outside the airport-noise-impacted area and the land located inside the 65-L_{dn} contour. The gradual change from the unprotected community area to the requirements for land inside the 65-L_{dn} contour will result in a more gradual increase in construction costs.

ACQUISITION AREA REDEVELOPMENT PROGRAM

The acquisition area redevelopment program should be undertaken as a cooperative effort by the Airport Authority, city and county governments, and civic/neighborhood organizations. The primary objective of the program is to increase the level of stability or equilibrium in neighborhoods surrounding the airport.

The program is divided into three components: **property acquisition, redevelopment plan, and noise barriers.**

Property Acquisition

The Memphis-Shelby County Airport Authority has committed to the acquisition of single-family dwelling units located inside the 75-L_{dn} noise contour, representing future operations with all master plan facilities in place.

The Airport Authority recently agreed to acquire houses located south of Winchester along Nancy Road, and west of Nancy Road to the airport property. The land will be used for construction of the relocated Swinnea Road on the east side of the airport and for airport expansion.

Land acquired by the Authority in the Charjean, Whitehaven, and Greenbrook areas should be used in accordance with the land use plan guidelines described in the "Special Treatment Areas" section of this report. The methods recommended to be used for redevelopment of the cleared tracts are reviewed in this section of the plan.

In carrying out the intent of this plan to guide reuse of buyout area land and to stabilize neighborhoods adjoining buyout areas, it may be necessary for a unit of government to acquire additional parcels not included in the residential buyout program. These decisions to buy additional parcels must be made on a case-by-case basis. The land acquired must be purchased to remove any obstacle preventing the orderly redevelopment of the area and achieving a level of development benefitting the public. A specific source of funds must also exist prior to undertaking the additional land acquisition actions.

For acquisition area land located in Greenbrook, the Airport Authority and the City of Southaven should initiate discussions to outline steps necessary to sell the cleared residential property for public uses. Issues to be resolved include:

1. Cost of property owned by the Airport Authority
2. Future use and ownership of the property
3. Responsibility for closing public streets, adjustments in the utility infrastructure, and removal of pavement from closed streets

4. Responsibility for installing special "buffer zone" treatments along the edge of the buyout area and adjacent to remaining single-family residences

The City of Southaven, DeSoto County, and the Airport Authority should investigate ways of establishing a noise-insulation program for existing homes located outside the buyout area but in the high-noise-impact area. A similar noise insulation program is recommended for implementation in Tennessee through the community redevelopment planning process.

Redevelopment

The "Special Treatment Areas" section of this report provides the specific reuse in the STAs for single-family land acquired by the Authority.

Definition of the land-management options for transferring the acquired land back to private ownership for reuse includes two primary approaches. First, after acquiring the property, relocating residents, and assembling the small lots into larger tracts, the Airport Authority could seek changes in zoning and put in place other land use controls to permit nonresidential activities to be placed on the assembled property. Through zoning controls and binding agreements extended to the sale of the property, the Authority could guide future development to increase the property's compatibility with adjoining uses, as well as eliminate land uses that would be adversely affected by aircraft noise. Having accomplished rezoning, the property could be sold to private parties.

This process has several weaknesses. The Authority will be required to become an active participant in the land development process. Resale of its assembled tracts will require the agency to define the legally binding controls on reuse of the land, seek buyers for the property, evaluate offers based on varying proposed reuse plans, consummate the land sale, and monitor redevelopment of the land to see that all land use agreements are carried out by the buyer.

The Authority may also be placed in a position of having to sell large quantities of their assembled property to raise funds to close out the remaining property acquisition program in the buyout areas. The Authority could be placed in a position of selling land in a soft market that would provide a lower rate of return than land sold under stronger market conditions.

Finally, the total amount of funds made available to the Authority to be applied to solving the high-noise problem would be limited to the funds raised from resale of the acquired land. If the land is sold under soft market conditions, the funds will be further diminished.

In contrast to the first option where the primary role is played by the Authority, a second approach for buyout area property located in Tennessee places primary responsibility for land management on local government's redevelopment process. By use of "redevelopment" and "tax increment finance district" legislation, a program that transfers responsibility to other units of local government may also generate additional funds for noise-mitigation activities. In brief, the second option calls for:

1. Designation of a redevelopment authority agency; state law identifies the Housing Authority or another delegated body as the implementing agency.

2. Preparation and adoption of a redevelopment plan for project areas, including the buyout areas.

3. Raising public funds through the sale of revenue bonds, the pledging of Community Development Block Grant funds, or some other means.

4. Acquisition from the Airport Authority of property located in the buyout areas, with payment made from part of the public funds.

5. Management of the land sale redevelopment program to enhance the long-term utility of the buyout area, as well as provide funds for other noise-mitigation activities.

6. Using increased tax revenues from the redeveloped buyout area property to repay the public (revenue bond or community development) funds.

Use of the "redevelopment" approach will assign land management responsibilities to the government agency designated to perform community rebuilding programs. This will relieve the Airport Authority from dealing with community land use issues and permit it to concentrate on operating the airport. In Mississippi, the majority of the buyout area is designated for public-use facilities, so the redevelopment authority approach will not be necessary.

In applying its legislative powers, the redevelopment agency has the ability to acquire additional land other than single-family houses inside the 75-L_{dn} contour. This additional property can then be added to the buyout area tracts to permit the successful redevelopment of the land.

The redevelopment program can place on the market appropriately located buyout area tracts to respond to market-driven demands. Following construction of private development on the property, the tax increment finance program can direct part of the increase in property tax revenues derived from the construction of improvements to retire the revenue bonds or repay community development block grant funds. In addition to paying the Airport Authority for the acquisition of the buyout areas, proceeds from the bond or community development funds can be used to assist in the provision of noise-proofing existing houses in designated areas, as well as installation of local streets and infrastructure required for development of the buyout area tracts.

Tax increment financing (TIF) is a method of funding certain public investments necessary for redevelopment by recapturing, for a time, all or a portion of the increased tax revenue which may result if private investment can be stimulated. As private investments add to the tax base within a redevelopment area, the increased revenues are placed in a special fund which can only be used for the purposes spelled out in the redevelopment plan. The financing arrangement pledges the increased tax revenue so that public funding can be provided for "front-end" expenses, such as infrastructure improvements or land assembly. The TIF financing method uses the revenue increase which will result from redevelopment to fund the extraordinary costs of redevelopment. This is a redevelopment-from-within, or bootstrap technique.

Tax increment financing can only be generated by the increased taxes resulting from private development of land in a redevelopment district. That land must have been acquired and resold or leased by the Housing Authority or designated redevelopment agency. The tax increment is the difference between the property taxes generated at the time the property was acquired by the agency and the tax yield in each year after the property is sold. The tax increment is then allocated to the redevelopment agency to finance public purpose expenditures or to repay bonds or notes floated to finance those expenditures.

During preparation of the redevelopment plan, the Airport Authority and the redevelopment agency must review a variety of issues and determine a strategy for the assignment of responsibility. For example:

1. What are the realistic funding levels that can be derived from revenue bond sales supported by the tax increment finance program?

2. What additional funds can the airport direct into the redevelopment program through financial resources available to it?

3. Where are the priority buyout area development tracts that, when developed, best promote the redevelopment effort and generate TIF revenue necessary to support the redevelopment program?

4. How can the staging of improvements be scheduled with the expenditure of public funds and the Airport Authority's funds to maximize private investment?

An additional method of land acquisition is "neighborhood, or private land, assembly." This method may be part of the implementation tools used within an adopted redevelopment area, or it may be privately initiated without the adoption of a redevelopment plan.

Neighborhood assembly is often initiated by a developer looking for a large tract of land to develop, but is sometimes initiated by a group of residents who recognize that the character of their neighborhood has changed or is changing, and that market forces (or other forces) are pushing toward eventual conversion of the land from a residential neighborhood into some form of commercial development.

In such cases, the neighborhood residents may organize themselves for the purpose of marketing their land as a complete package and finding someone who will buy the land and develop it in a way that conforms better with the community's long-term plans and development trends. They may even select a broker to market the property and to represent the property owners in negotiations with the purchaser/developer.

The prices of neighborhood assembly are usually higher than properties sold to developers in a piecemeal fashion. With the cooperation of all affected landowners, the developer seeking to purchase a large tract of land runs much less risk that one or more landowners will refuse to sell part of the entire tract. Critical to this neighborhood assembly arrangement is an agreed-upon method for dividing the proceeds from the sale. This can be based on a variety of factors, operating either alone or together. For example, the proceeds could be divided on a per-owner or per-square-foot basis, or could be based on the replacement value of individual houses. The landowners could even put their property into a partnership in exchange for a partnership interest in the eventual development.

Where the neighborhood assembly effort is in accordance with an adopted land use plan for the area, there is one less hurdle.

Local government does not play an entirely passive role in the neighborhood assembly process. The principal role of local government is the approval of the new development planned for the assembled land. Local government can also take more active steps in making sure that the zoning of the land accommodates the planned development, and in making sure that public services and infrastructure are adequate to serve the development. If the posture of public agencies is that the proposed assembly is consistent with the adopted land use plan and zoning for the area, then it will be easier for the property owners to market the assembled land for nonresidential development. Local government can even play a role in initiating and facilitating citizen involvement in the neighborhood assembly process. This role involves providing the affected property owners with a place to meet and making local government staff available to assist with research and other needs of the persons pooling their land.

However, neighborhood assembly efforts are complicated, and a variety of factors determine their success or failure. These factors may not exist in every case. First, it appears that the smaller the area, the better. Most of the successful neighborhood assembly efforts have involved areas of less than 100 acres. The reasons are obvious. Most developers are not looking for very large amounts of land; therefore, the smaller the area, the more marketable it is to developers. In addition, when the area is smaller, chances are that there are fewer individual property owners who must come to agreement on the terms of the assembly and sale to a developer. The greater the number of property owners involved, the lesser the chance for agreement among them.

Second, there must be a ready market for the assembled land. If not, then the cooperating property owners will be disappointed in their neighborhood assembly efforts. The principal reason is that the market will not support the price that they think their property is worth. As a result, neighborhood assembly may not be feasible in all instances.

Noise Barriers

Properly designed and constructed noise barriers in the form of walls, earthen berms, large buildings, or a combination of any of these three can provide noticeable reduction in community noise levels generated by aircraft on the ground. Noise-sensitive areas to the east and west of the 18/36 runways are exposed principally to noise generated by aircraft on the ground, and use of barriers could make the noise environments here more compatible with the residential development. Hence, noise barriers can play a part in stabilizing communities by improving their noise environments.

Noise barrier effectiveness depends upon the distance from the noise source to the noise-sensitive receiver's location; the barrier location, height, and length; the terrain between the source and the receiver; and the frequency content of the noise. Additionally, the relative elevations of the noise source, the receiver, and the top of the barrier are important. In general, the barrier should be as close as possible to either the source or the receiver, and it should block the view of the noise source, as observed from the noise-sensitive receiver's location.

Barriers are most effective for receiver locations directly behind them and provide less benefit at locations further away. Hence, a barrier constructed at the edge of a neighborhood can provide significant noise reductions for houses nearby, but may provide no noticeable reduction at houses one or two lots further away.

Analytical methods that permit computation of barrier effectiveness are available. Using detailed information about the geometry of source and receiver, measurements of source noise levels and spectra, measurements of terrain effects, and wind data, it is possible to compute how much noise-reduction barriers could provide for various locations within the community.

Barrier analysis should commence with an assessment of whether barriers can provide any noticeable noise reductions. Then barrier locations that are desirable from an acoustics perspective should be reviewed for other feasibility considerations, such as land availability, rights-of-way, and height restrictions. Locations that are feasible from these perspectives may then undergo detailed analysis. Community involvement is generally advisable after barrier noise reductions have been determined. Residents will have to look at the barrier once it is built, and their opinions should be heard before a final commitment is made to conduct final barrier design and construction.

Finally, noise barrier construction projects can be eligible for FAA participation in funding. FAA Order 5100.38A provides the following guidance.

714. Noise Barriers. Noise barriers may be effective in certain locations to reduce adverse noise impacts, particularly from maintenance areas and loading gates. Generally, such activities do not make a substantial contribution to total noise exposure, but single-event occurrences may disrupt nearby classrooms or residences. Noise barriers, earth berms, wall structures, "hush houses," and other devices designed to shield areas from noises generated by the airport are eligible, with the following provisions:

a. Noise barriers must be located and constructed in areas which benefit noncompatible uses affected by single-event ground operation noise that interferes with sleep and conversation. A single-event noise reduction of at least 5 decibels should be realized at the nearest noncompatible land use.

b. The construction or installation must mitigate noise from a variety of airport users. For example, a hush house in the leased area of an airline maintenance facility is not eligible. If the airport sponsor proposes to designate an area of the airport for all engine run-ups, however, a noise barrier or hush house may be eligible to shield nearby areas from such activities.

c. Noise barriers must be designed to ensure that they do not violate airport design standards or Part 77 surfaces.

d. Landscaping costs in conjunction with noise barrier or berm construction are allowable only for materials necessary to stabilize soil against wind or water erosion.

e. If not done in conjunction with evaluation of alternatives in the Part 150 Study, a cost-benefit analysis should be conducted which compares the effectiveness of the proposed noise barrier with other feasible alternatives, such as land acquisition and noise insulation.

IMPLEMENTATION PROCESS

The implementation program contains a variety of recommended actions; some can be tied to a specific period of time, while others will require numerous actions which will dictate the timing of events.

*The adoption of amendments to the zoning ordinances to include the planned business park and planned office park districts must be undertaken by the individual governmental jurisdiction. It is recommended that the process be completed in 1991 so that these districts can be used immediately to guide land development.

The adoption of amendments to the zoning map in each local governmental jurisdiction is a continuous process administered by the local planning/building agencies. The reclassification of property from one zoning district to another is an action that can only be taken by the legislative body that adopted the zoning ordinance. The need to consider a change in the district classification of a property is in response to an application/request filed by the affected property owner or by an authorized unit of government. In both events, applications can be filed at any time, and the legislative body must consider the land use plan recommendations and the content of the rezoning application, and must then approve or deny the request. In carrying out recommendations of this land use plan, it may be practical for government, from time to time, to be the applicant for the reclassification of large areas or a group of properties to zoning districts that permit uses recommended in the land use plan. Reclassification of property in the buyout areas from

residential to a planned office district is an example of such a government-sponsored rezoning application.

*Amendments to the building code of local jurisdictions to improve the exterior noise abatement performance of new structures should be initiated in 1991. The amendments will produce immediate positive results for all new structures whose use would otherwise be adversely affected by high aircraft-noise levels.

*The capital construction budgeting process is a continuous function performed by local governmental jurisdictions. The expenditure of public funds on permanent improvements (e.g., bridges, roads, sewers, and schools) must be made within the context of needs expressed by the local community and limitations placed on the use of public money from particular government sources. Coordination of the capital budgeting process to facilitate the reabsorption of buyout property into the community, to help stabilize existing sound areas adjacent to the buyout areas, and to absorb new urban development is an objective of this plan.

*The community stabilization program has several components which must be coordinated over time. First, the buyout program currently being implemented by the Airport Authority will continue, matching the available funds with requests for property acquisition by owners of single-family property in the buyout areas.

*Acquisition of other parcels may also be necessary to facilitate the successful redevelopment of these areas. For example, it may be necessary, under provisions of the redevelopment law, to acquire isolated residences remaining in an otherwise cleared buyout area. Also, if isolated nonresidential properties restrict redevelopment of cleared adjacent buyout property, the nonresidential property may have to be acquired and consolidated with the larger cleared area to facilitate reuse.

Management of an effective land acquisition program required to facilitate the redevelopment process must prudently spend limited public funds only when necessary to remove impediments to reuse. The packaging of redevelopment tracts for private reuse must take into account demand for property in the land development marketplace and implications for the tax increment funded program. Land acquisition is therefore an integral part of the redevelopment process.

The staging of the redevelopment program activities must be organized to achieve realistic goals with available resources. Beginning in 1990, local governmental jurisdictions in Tennessee should undertake a discussion of the mechanisms of the redevelopment process, the assignment of responsibility, and the potential funding resources. Several options raised in this plan that should be explored include the use of tax increment financing as a principal source of redevelopment funds; the initiation of a noise insulation program in existing residences in areas adjacent to buyout areas; the transfer of ownership of land in the buyout areas from the Airport Authority to the redevelopment agency for management of a community redevelopment program; and the extent of activities that can be undertaken by the Authority to support redevelopment.

*The first redevelopment project could include the buyout area located in the southwest quadrant of the intersection of Winchester and Airways. Initial observations made as a result of land use/market studies prepared as part of this planning program indicate this to be a prime location. This tract may have resale potential for development in the short term due to its proximity to arterial streets, the airport terminal, and the adjacent offices of Federal Express. Development of this tract would form the basis for structuring the tax increment program. The construction of noise barriers, and acquisition of nonresidential uses could all be components of the redevelopment program.

*The use of redevelopment funds from the Winchester/Airways area as seed money for additional redevelopment projects should also be considered. Actions including a noise insulation program for existing residences, construction of properly designed noise barriers, and development of a buffer zone strip separating the residences from the airport property and Swinnea Road are three potential elements

*Implementation of redevelopment activities in Charjean should also receive early action. Due to the extent of land acquisitions required in the area to permit effective marketing of the buyout area, implementation of the program will require an extended period of time. Assembled redevelopment tracts located in the vicinity of Airways will likely have more initial market appeal than tracts located in the center of the buyout area. A specific redevelopment strategy must be prepared for Charjean by balancing available funds with redevelopment construction.

*Subsequent redevelopment areas should focus on the reuse of additional tracts located along Airways south of Winchester and the conversion of the residential land use pocket located at Knight Arnold Road and Linda Drive to nonresidential use. The timing of activity in the Airways corridor must be sensitive to potential office space market demand and the need to stabilize conditions in the adjoining residential area. The timing of redevelopment in the Knight Arnold area must also acknowledge real estate market demands for well-located industrial property. The possibility of initiating a neighborhood assembly device to market this area should be explored as a low public-cost option.

*The initiation of an active noise barrier construction program must, as has been cited above, be coordinated with other redevelopment/stabilization actions. Use of noise barriers must be supported by technical design studies to verify their effectiveness, community interaction to ensure their positive visual contribution to the area, and identification of a funding source to cover their installation and maintenance. The control of the design of new buildings in the buyout areas may also contribute to noise reduction in adjacent residential areas, due to the massing of the structures and their ability to absorb or reflect ground-generated aircraft noise.

*Opportunities to better coordinate the patterns used by aircraft operating in and out of the Memphis Airport should be explored. The process for examining adjustments in the patterns should be initiated in 1991.

APPENDICES

APPENDIX A

ACTIVITY CENTER STANDARDS

Neighborhood Activity Center:

- Size: 15 to 35 acres
- Retail Commercial: 50,000- to 150,000-sq.ft. floor area
- Housing: 50 to 150 dwelling units (5.9 to 10 dwelling units per acre)
- Office: 20,000- to 30,000-sq.ft. floor area
- Service Area: 1 to 3 miles (serves 2 to 4 neighborhoods)
- Principal Uses: Convenience store or supermarket, drug store, service station, restaurant, dry cleaning, bank, personal services
- Other uses: Day care center, professional offices

Community Activity Center:

- Size: 35 to 60 acres
- Retail Commercial: 150,000- to 300,000-sq.ft. floor area
- Housing: 150 to 300 dwelling units (10.1 to 15 dwelling units per acre)
- Office: 30,000- to 50,000-sq.ft. floor area
- Service Area: 7- to 10-minute driving time (serves 2 to 4 neighborhoods)
- Principal Uses: Supermarket, drug store, discount store, service station, restaurant, bank, athletic goods, similar facilities
- Other Uses: Professional offices, recreational center, swimming pool

Regional Activity Center:

- Size: 60 to 100 acres
- Retail Commercial: 300,000- to 750,000-sq.ft. floor area
- Housing: 200 to 400 dwelling units (15 to 30 dwelling units per acre)
- Office: 50,000- to 100,000-sq.ft. floor area
- Service Area: 10- to 15-minute driving time (serves more than one community)
- Principal Uses: Discount store, supermarket, drug store, service station, restaurants, variety store, athletic store, television/appliance store, bank
- Other Uses: Professional offices, library, police substation, bowling lanes, community theater, fire station

Urban Activity Center:

- Size: 100 acres or more
- Retail Commercial: 750,000- or more sq.ft. floor area with the capacity to expand
- Housing: 500 or more dwelling units (15 to 50 dwelling units per acre)
- Office: 100,000- or more sq.ft. floor area
- Service Area: Minimum 5-mile radius
- Principal Uses: Department store, restaurant, athletic store, appliance store, discount store, professional office
- Other Uses: Library, health facility, fire and police station, municipal center

APPENDIX B

Table 1.

PROJECTED 2010 DAILY TRAFFIC VOLUME CHARACTERISTICS

Roadway	Segment	Pavement X-Sect./ R/W Width	No. of Lanes	LOS D Service Volume	2010 Plan Volume	V/C	LOS
Church Road	Tulane Rd. - U.S. 51 (S)	48'/106'	4U(4-4.2)	21,500	3,648	0.15	A
	U.S. 51 (S) - I-55	48'/106'	4U(4-4.2)	21,500	N/A	N/A	N/A
	I-55 - Airways Blvd.	48'/106'	4U(4-4.2)	21,500	N/A	N/A	N/A
	Airways Blvd. - Swinnea Rd.	48'/106'	4U(4-4.2)	21,500	N/A	N/A	N/A
	Swinnea Rd. - Tchlahoma Rd.	48'/106'	4U(4-4.2)	21,500	40,953	1.71	F
Nail Road	Horn Lake Rd. - Tulane Rd.	48'/106'	4U(4-4.2)	21,500	5,941	0.25	A
	Tulane Rd. - U.S. 51 (S)	48'/106'	4U(4-4.2)	21,500	28,941	1.21	F
Goodman Road	W/ Horn Lake Rd.	48'/114'	4U(4-4.2)	21,500	11,270	0.47	A
	Horn Lake Rd. - Tulane Rd.	64'/114'	5 (4-5)	30,000	39,053	1.17	F
	Tulane Rd. - U.S. 51 (S)	64'/114'	5 (4-5)	30,000	26,762	0.80	C
	U.S. 51 (S) - I-55	64'/114'	5 (4-5)	30,000	22,301	0.67	B
	I-55 - Airways Blvd.	64'/114'	5 (4-5)	30,000	40,753	1.22	F
	Airways Blvd. - Swinnea Rd.	64'/114'	5 (4-5)	30,000	48,677	1.45	F
	Swinnea Rd. - Tchulahoma Rd.	48'/114'	4U(4-4.2)	21,500	30,989	1.29	F
	Tchulahoma Rd. - Getwell Rd.	48'/114'	4U(4-4.2)	21,500	30,989	1.29	F
	Getwell Rd. - Malone Rd.	48'/114'	4U(4-4.2)	21,500	7,427	0.31	A
	Malone Rd. - Pleasant Hill Rd.	48'/114'	4U(4-4.2)	21,500	7,397	0.31	A
	Pleasant Hill Rd. - Davidson Rd.	48'/114'	4U(4-4.2)	21,500	7,817	0.33	A
State Line Road	Horn Lake Rd. - Tulane Rd.	64'/106'	5 (4-5)	30,000	19,769	0.59	A
	Tulane Rd. - U.S. 51 (S)	64'/106'	5 (4-5)	30,000	9,958	0.30	A
	U.S. 51 (S) - Mill Branch Rd.	64'/80'	5 (4-5)	30,000	20,333	0.61	B
	Mill Branch Rd. - I-55	64'/114'	5 (4-5)	30,000	20,333	0.61	B
	I-55 - Airways Blvd.	64'/114'	5 (4-5)	30,000	23,445	0.70	B
	Airways Blvd. - Swinnea Rd.	48'/106'	4U(4-4)	24,000	19,477	0.73	C
	Swinnea Rd. - Tchulahoma Rd.	48'/106'	4U(4-4)	24,000	17,042	0.64	B
	Tchulahoma Rd. - Getwell Rd.	48'/106'	4U(4-4)	24,000	29,669	1.12	F
	Getwell Rd. - Malone Rd.	48'/106'	4U(4-4)	24,000	31,195	1.18	F
	Malone Rd. - Pleasant Hill Rd.	48'/106'	4U(4-4)	24,000	7,433	0.28	A
Holmes Parkway	Tulane Rd. - U.S. 51 (S)	88'/108'	7 (4-7)	42,000	21,456	0.46	A
	U.S. 51 (S) - Mill Branch Rd.	88'/108'	7 (4-7)	42,000	23,365	0.50	A
	Mill Branch Rd. - I-55	88'/108'	7 (4-7)	42,000	N/A	N/A	N/A
	I-55 - Queen Eliz. Fwy.	88'/108'	7 (4-7)	42,000	12,195	0.26	A
	Queen Eliz. Fwy. - Hornsby Dr.	88'/108'	7 (4-7)	42,000	12,195	0.26	A
	Hornsby Dr. - Airways Blvd.	88'/108'	7 (4-7)	42,000	12,195	0.26	A
	Airways Blvd. - Swinnea Rd.	108'/160	4DE(2-4)	36,000	9,982	0.25	A
	Swinnea Rd. - Tchulahoma Rd.	108'/160	4DE(2-4)	36,000	10,550	0.26	A
	Tchulahoma Rd. - Getwell Rd.	108'/160	4DE(2-4.2)	34,000	19,279	0.53	A
	Getwell Rd. - Malone Rd.	108'/160	4DE(2-4.2)	34,000	12,317	0.34	A
	Malone Rd. - Pleasant Hill Rd.	108'/160	4DE(2-4.2)	34,000	3,861	0.11	A
	Pleasant Hill Rd. - U.S. 78	108'/160	4DE(2-4.2)	34,000	2,365	0.06	A
Shelby Drive	U.S. 51 (S) - Mill Branch Rd.	94'/114'	5 (4-5)	30,000	37,980	1.13	F
	Mill Branch Rd. - I-55	70'/90'	6DA(3-6)	38,500	38,584	0.91	E
	I-55 - Airways Blvd.	88'/108'	7 (4-7)	42,000	47,794	1.03	F
	Airways Blvd. - Swinnea Rd.	88'/108'	7 (4-7)	42,000	50,788	1.09	F
	Swinnea Rd. - Tchulahoma Rd.	88'/108'	7 (4-7)	42,000	50,788	1.09	F
	Tchulahoma Rd. - Getwell Rd.	88'/108'	7 (4-7)	42,000	54,917	1.18	F
	Getwell Rd. - Malone Rd.	94'/114'	6DA(3-6)	38,500	41,504	0.98	E

Roadway	Segment	Pavement X-Sect./ R/W Width	No. of Lanes	LOS D Service Volume	2010 Plan Volume	V/C	LOS
Raines Road	I-55 - Airways Blvd.	64'/84'	5 (4-5)	30,000	23,974	0.72	C
	900' W/Getwell Rd. - Getwell Rd.	88'/108'	7 (4-7)	42,000	5,359	0.12	A
Winchester Road	ICGRR - Tulane Rd.	88'/108'	7 (4-7)	42,000	32,265	0.69	B
	Tulane Rd. - McCorkle Rd.	88'/108'	7 (4-7)	42,000	13,278	0.29	A
	McCorkle Rd. - U.S. 51(S)	88'/108'	7 (4-7)	42,000	16,331	0.35	A
	U.S. 51(S) - I-55	88'/108'	7 (4-7)	42,000	26,891	0.58	A
	I-55 - Mill Branch Rd.	88'/108'	7 (4-7)	42,000	28,744	0.62	B
	Mill Branch Rd. - Airways Blvd.	88'/108'	7 (4-7)	42,000	49,850	1.07	F
	Airways Blvd. - Plough Blvd.	88'/108'	7 (4-7)	42,000	32,523	0.70	B
	Plough Blvd. - Airport Exit	88'/108'	7 (4-7)	42,000	41,599	0.89	D
	Airport Exit - Airport Runway	86'/106'	7 (4-7)	42,000	41,599	0.89	D
	Airport Runway - Airport Runway	86'/106'	7 (4-7)	42,000	44,062	0.95	E
	Airport Runway - Swinnea Rd.	86'/106'	7 (4-7)	42,000	44,062	0.95	E
	Swinnea Rd. - Tchlahoma Rd.	86'/106'	7 (4-7)	42,000	44,062	0.95	E
	Tchulahoma Rd. - New Getwell Rd.	86'/106'	7 (4-7)	42,000	77,541	1.67	F
	New Getwell Rd. - BNRR	72'/106'	7 (4-7)	42,000	34,997	0.75	C
	BNRR - Lamar Av.	72'/106'	6U(4-6)	36,000	34,997	0.87	D
	Lamar Av. - 2500' E/Lamar Av.	72'/106'	6U(4-6)	36,000	38,211	0.96	E
	2500' E/Lamar Av. - Perkins Rd.	84'/106'	7 (4-7)	42,000	38,211	0.82	D
	Perkins Rd. - Mendenhall Rd.	84'/106'	7 (4-7)	42,000	46,917	1.01	F
Brooks Road	ICGRR - Tulane Rd.	86'/106'	7 (4-7)	42,000	23,900	0.51	A
	Tulane Rd. - Elvis Presley Blvd.	86'/106'	7 (4-7)	42,000	42,488	0.91	E
	Elvis Presley Blvd. - I-55	86'/106'	7 (4-7)	42,000	41,120	0.88	D
	I-55 - Mill Branch Rd.	86'/106'	7 (4-7)	42,000	28,433	0.61	B
	Mill Branch Rd. - Airways Blvd.	86'/106'	7 (4-7)	42,000	34,871	0.75	C
Democrat Road	Mill Branch Rd. - Days Creek	88'/108'	7 (4-7)	42,000	12,738	0.27	A
	Days Creek - Airways Blvd.	84'/106'	7 (4-7)	42,000	12,738	0.27	A
	Airways Blvd. - Tchulahoma Rd.	66'/100'	5 (4-5)	30,000	64,488	1.93	F
	Tchulahoma Rd. - Lamar Av.	66'/100'	5 (4-5)	30,000	15,132	0.45	A
American Way	Democrat Rd. - Lamar Av.	70'/106'	4D(3-4)	24,000	20,008	0.76	C
	Lamar Av. - Getwell Rd.	70'/106'	4D(3-4)	24,000	27,234	1.03	F
	Getwell Rd. - Cherry Rd.	70'/90'	4D(3-4)	24,000	49,374	1.86	F
	Cherry Rd. - Perkins Rd.	70'/90'	6D(3-6)	38,500	60,304	1.42	F
Ball Road	Norris Rd. - Perry Rd.	60'/70'	5 (4-5)	30,000	8,524	0.25	A
	Perry Rd. - Ketchum Rd.	72'/82'	6U(4-6)	30,000	7,014	0.21	A
Norris Road	I-240 - Elvis Presley Blvd.	66'/80'	5 (4-5)	30,000	N/A	N/A	N/A
	Elvis Presley Blvd. - Ball Rd.	60'/70'	5 (4-5)	36,000	N/A	N/A	N/A
Dunn Road	Elvis Presley Blvd. - Warren St.	64'/84'	5 (4-5)	30,000	2,435	0.07	A
	Warren St. - Perry Rd.	64'/84'	5 (4-5)	30,000	2,513	0.08	A
	Perry Rd. - Airways Blvd.	56'/70'	5 (4-5)	30,000	6,667	0.20	A
	Airways Blvd. - Frisco Av.	48'/62'	5 (4-5)	30,000	N/A	N/A	N/A

Roadway	Segment	Pavement X-Sect./ R/W Width	No. of Lanes	LOS D Service Volume	2010 Plan Volume	V/C	LOS
Hollywood St.	Southern Av. - Central Av.	60'/80'	5 (4-5)	30,000	7,738	0.23	A
Swinnea Road	Church Rd. - Joanne Dr.	24'/106'	2 (4-2)	7,500	Req Seg. (Min. 2L)		
	Joanne Dr.- Goodman Rd.	48'/106'	4U(4-4.2)	21,500	Req Seg. (Min. 2L)		
	Goodman Rd. - State Line Rd.	48'/106'	4U(4-4.2)	21,500	11,543	0.48	A
	State Line Rd. - TN/MS St. Line	48'/106'	4U(4-4.2)	21,500	4,632	0.19	A
	TN/MS State Line - Holmes Pkwy.	88'/108'	7 (4-7)	42,000	3,025	0.07	A
	Shelby Dr. - Winchester Rd.	48'/66'	4U(4-4.2)	21,500	-- Under Design --		
Tchulahoma Road	Church Rd. - Nail Rd.	48'/106'	4U(4-4.2)	21,500	Req Seg. (Min. 2L)		
	Nail Rd. - Goodman Rd.	48'/106'	4U(4-4.2)	21,500	Req Seg. (Min. 2L)		
	Goodman Rd. - State Line Rd.	48'/106'	4U(4-4.2)	21,500	Req Seg. (Min. 2L)		
	State Line Rd. - TN/MS St. Line	48'/106'	4U(4-4.2)	21,500	Req Seg. (Min. 2L)		
	TN/MS State Line - Holmes Pkwy.	88'/108'	7 (4-7)	42,000	Req Seg. (Min. 2L)		
	Holmes Pkwy. - Shelby Dr.	88'/108'	7 (4-7)	42,000	3,961	0.09	A
	Shelby Dr. - Raines Rd.	88'/108'	7 (4-7)	42,000	13,246	0.28	A
	Raines Rd. - Winchester Rd.	86'/106'	7 (4-7)	42,000	16,273	0.35	A
	Wnchstr Rd. - Knight Arnold Rd.	86'/106'	7 (4-7)	42,000	23,536	0.51	A
	Knight Arnold Rd. - Democrat Rd.	86'/106'	7 (4-7)	42,000	116,968	2.52	F
	Democrat Rd. - Lamar Av.	88'/108'	7 (4-7)	42,000			
Getwell Road	Goodman Rd. - State Line Rd.	68'/114'	4D(3-4.2)	21,500	1,519	0.06	A
	State Line Rd. - TN/MS St. Line	68'/114'	4D(3-4.2)	21,500	N/A	N/A	N/A
	TN/MS State Line - Holmes Pkwy.	94'/114'	6D(3-6)	38,500	35,479	0.83	D
	Holmes Pkwy. - Shelby Dr.	94'/114'	6D(3-6)	38,500	39,094	0.92	E
	Shelby Dr. - Crowfarm Dr.	92'/141'	7 (4-7)	42,000	34,970	0.75	C
	Crowfarm Dr. - Raines Rd.	68'/160'	4D(3-4)	36,000	40,598	1.01	F
	Raines Rd. - Winchester Rd.	68'/160'	4DE(2-4)	36,000	34,166	0.85	D
	Winchester Rd. - Lamar Av.	68'/160'	4DE(2-4)	36,000	48,163	1.20	F
	Lamar Av. - Knight Arnold Rd.	68'/160'	4DE(2-4)	36,000	43,030	1.08	F
	Knight Arnold Rd. - American Way	88'/160'	7 (4-7)	42,000	37,011	0.80	C
	American Way - I-240	88'/108'	7 (4-7)	42,000	45,534	0.98	E
	I-240 - Willow Rd.	60'/80'	5 (5-4)	30,000	32,735	0.98	E
Perkins Road	Winchester Rd. - Cottonwood Rd.	72'/106'	4D(3-4)	21,500	32,991	1.37	F
	Cottonwood Rd. - American Way	90'/114'	6D(3-6)	38,500	39,564	0.93	E
	American Way - I-240	90'/114'	6D(3-6)	38,500	81,544	1.92	F
	I-240 - Willow Rd.	60'/80'	5 (5-4)	30,000	27,863	0.83	D
Plsnt Hill Road	Goodman Rd. - State Line Rd.	48'/106'	4U(4-4.2)	21,500	N/A	N/A	N/A
	State Line Rd. - TN/MS St. Line	48'/106'	4U(4-4.2)	21,500	N/A	N/A	N/A
	TN/MS State Line - Holmes Pkwy.	94'/114'	6D(3-6)	38,500	N/A	N/A	N/A
Mendenhall Road	Winchester Rd. - Cottonwood Rd.	80'/100'	6U(4-6)	36,000	28,487	0.71	C

Roadway	Segment	Pavement X-Sect./ R/W Width	No. of Lanes	LOS D Service Volume	2010 Plan Volume	V/C	LOS
South Pkwy East	I-240 - Bellevue Blvd.	110'/138'	6D(3-6)	38,500	17,833	0.42	A
	Bellevue Blvd. - Pillow St.	110'/138'	6D(3-6)	38,500	13,562	0.32	A
	Pillow St. - Silver St.	48'/90'	5 (4-5)	30,000	13,459	0.40	A
	Silver St. - Kyle Rozelle St.	110'/138'	6D(3-6)	38,500	17,835	0.42	A
	Kyle Rozelle St. - Lamar Av.	148'/176'	6D(3-6)	38,500	17,835	0.42	A
Park Avenue	Lamar Av. - Airways Blvd.	54'/66'	5 (4-5)	30,000	12,200	0.36	A
	Airways Blvd. - Semmes St.	54'/66'	5 (4-5)	30,000	17,211	0.51	A
	Semmes St. - Highland Av.	54'/66'	5 (4-5)	30,000	19,973	0.60	A
	Highland Av. - Getwell Rd.	54'/66'	5 (4-5)	30,000	28,963	0.86	D
Southern Avenue	Cooper St. - East Parkway S.	54'/64'	5 (4-5)	30,000	7,474	0.22	A
	East Parkway S. - Goodwyn St.	54'/66'	5 (4-5)	30,000	14,279	0.43	A
Central Avenue	Cooper St. - Parkway E.	50'/70'	4U(4-4)	24,000	20,100	0.76	C
	Parkway E. - Semmes St.	54'/80'	5 (4-5)	30,000	19,517	0.58	A
Lamar Avenue	S. Parkway E. - Park Av.	60'/80'	6U(4-6)	36,000	42,114	1.05	F
	Park Av. - Airways Blvd.	66'/80'	6U(4-6)	36,000	42,114	1.05	F
	Airways Blvd. - Semmes St.	66'/80'	6U(4-6)	36,000	30,247	0.76	C
	Semmes St. - I-240	72'/92'	6U(4-6)	36,000	43,668	1.09	F
	I-240 - American Way	72'/92'	6U(4-6)	36,000	61,686	1.54	F
	American Way - Knight Arnold Rd.	72'/120'	6U(4-6)	36,000	110,156	2.75	F
	Knight Arnold Rd. - Getwell Rd.	72'/120'	7 (4-7)	42,000	39,640	0.85	D
	Getwell Rd. - Winchester Rd.	72'/88'	4D(3-4)	24,000	N/A	N/A	N/A
I-55	Church Rd. - Goodman Rd.	108'/300'	4DF(1-4)	60,000	N/A	N/A	N/A
	Goodman Rd. - State Line Rd.	108'/300'	4DF(1-4)	60,000	50,664	0.76	C
	@ TN/MS State Line	108'/300'	4DF(1-4)	60,000	51,589	0.78	C
	Shelby Dr. - Brooks Rd.	108'/300'	4DF(1-4)	60,000	58,522	0.88	D
	Brooks Rd. - Elvis Presley Blvd.	108'/300'	6DF(1-6)	81,000	75,809	0.84	D
	Elvis Presley Blvd. - I-240	108'/300'	6DF(1-6)	81,000	91,993	1.02	F
I-240	I-55 - Norris Rd.	100'/250	6DF(1-6)	81,000	103,559	1.15	F
	Norris Rd. - S. Parkway E.	100'/250	6DF(1-6)	81,000	84,934	0.94	E
	I-55 - Mill Branch Rd.	132'/300'	6DF(1-6)	81,000	108,156	1.20	F
	Mill Branch Rd. - Airways Blvd.	132'/300'	6DF(1-6)	81,000	151,158	1.68	F
	Airways Blvd. - Lamar Av.	156'/300'	8DF(1-8)	102,000	98,091	0.87	D
	Lamar Av. - Getwell Rd.	156'/300'	8DF(1-8)	102,000	101,869	0.91	E
	Getwell Rd. - Perkins Rd.	156'/300'	8DF(1-8)	102,000	95,478	0.85	D
Horn Lake Road	Nail Rd. - Goodman Rd.	22'/40'	4U(4-4.2)	21,500	19,489	0.81	D
	Goodman Rd. - DeSoto Rd.	20'/80'	4U(4-4.2)	21,500	8,854	0.37	A
	DeSoto Rd. - State Line Rd.	20'/80'	4U(4-4.2)	30,000	8,854	0.26	A
	State Line Rd. - TN/MS St. Line	20'/80'	5 (4-5)	30,000	N/A	N/A	N/A
	TN/MS State Line - Winsor Rd.	20'/40'	5 (4-5)	30,000	N/A	N/A	N/A

Roadway	Segment	Pavement X-Sect./ R/W Width	No. of Lanes	LOS D Service Volume	2010 Plan Volume	V/C	LOS
U.S. Hwy. 51 (S) (E. Presley Blvd.)	Church Rd. - Nail Rd.	70'/106'	4U(4-4.2)	21,500	34,240	1.43	F
	Nail Rd. - Goodman Rd.	70'/106'	4U(4-4.2)	21,500	37,297	1.55	F
	Goodman Rd. - State Line Rd.	70'/106'	5 (4-5)	30,000	25,386	0.76	C
	State Line Rd. - TN/MS St. Line	88'/108'	7 (4-7)	42,000	25,232	0.54	A
	TN/MS State Line - Holmes Pkwy.	88'/108'	7 (4-7)	42,000	19,725	0.42	A
	Holmes Pkwy. - Shelby Dr.	88'/108'	7 (4-7)	42,000	28,085	0.60	B
	Shelby Dr. - Raines Rd.	88'/108'	7 (4-7)	42,000	Outside Study Area		
	Raines Rd. - Winchester Rd.	88'/108'	7 (4-7)	42,000	Outside Study Area		
	Winchester Rd. - Brooks Rd.	88'/108'	7 (4-7)	42,000	43,339	0.93	E
	Brooks Rd. - I-55	88'/108'	7 (4-7)	42,000	43,339	0.93	E
	I-55 - I-240	88'/108'	7 (4-7)	42,000	32,284	0.69	B
	I-240 - Norris Rd.	72'/92'	6U(4-6)	36,000	27,080	0.68	B
	Norris Rd. - Dunn Rd.	64'/84'	5 (4-5)	30,000	23,643	0.59	A
	Dunn Rd. - S. Parkway E.	64'/84'	5 (4-5)	30,000	24,701	0.62	B
Mill Branch Road	State Line Rd. - TN/MS St. Line	26'/40'	2 (4-2)	7,500	12,115	1.43	F
	TN/MS State Line - Holmes Pkwy.	64'/84'	5 (4-5)	30,000	13,731	0.41	A
	Holmes Pkwy. - Shelby Dr.	64'/84'	5 (4-5)	30,000	29,235	0.87	D
	Shelby Dr. - Raines Rd.	60'/80'	5 (4-5)	30,000	25,301	0.76	C
	Raines Rd. - I-55	60'/80'	5 (4-5)	30,000	42,234	1.26	F
	I-55 - Winchester Rd.	60'/80'	5 (4-5)	30,000	42,234	1.26	F
	Winchester Rd. - Brooks Rd.	60'/80'	5 (4-5)	30,000	45,221	1.35	F
	Brooks Rd. - I-240	94'/114'	7 (4-7)	42,000	54,138	1.16	F
Perry Rd.	Ball Rd. - Dunn Rd.	N.A.	4U(4-4)	24,000	6,252	0.24	A
Airways Blvd.	Church Rd. - Goodman Rd.	24'/106'	2 (4-2)	7,500	Req Seg. (Min. 2L)		
	Goodman Rd. - State Line Rd.	48'/106'	4U(4-4)	24,000	9,332	0.35	A
	State Line Rd. - TN/MS St. Line	72'/106'	6U(4-6)	36,000	11,473	0.29	A
	TN/MS State Line - Holmes Pkwy.	88'/108'	7 (4-7)	42,000	15,511	0.33	A
	Holmes Pkwy. - Shelby Dr.	84'/106'	7 (4-7)	42,000	20,834	0.45	A
	Shelby Dr. - Raines Rd.	84'/106'	7 (4-7)	42,000	63,351	1.36	F
	Raines Rd. - 1000'S/Wnchstr Rd.	84'/106'	7 (4-7)	42,000	33,246	0.71	C
	1000'S/Wnchstr Rd. - Wnchstr Rd.	72'/90'	6U(4-6)	36,000	6,226	0.16	A
	Winchester Rd. - Brooks Rd.	94'/106'	6D(3-6)	38,500	31,368	0.74	C
	Brooks Rd. - Democrat Rd.	94'/106'	6D(3-6)	38,500	46,177	1.09	F
	Democrat Rd. - Plough Blvd.	62'/90'	6D(3-6)	38,500	46,177	1.09	F
	Plough Blvd. - I-240	76'/92'	6U(4-6)	36,000	121,492	3.04	F
	I-240 - Ketchum Rd.	76'/92'	6U(4-6)	36,000	61,605	1.54	F
	Ketchum Rd. - Dunn Rd.	72'/92'	7 (4-7)	42,000	40,134	0.86	D
	Dunn Rd. - BMRR	56'/70'	6U(4-6)	36,000	30,385	0.76	C
	BMRR - Person Av.	56'/70'	6U(4-6)	36,000	32,025	0.80	D
	Person Av. - Lamar Av.	72'/92'	7 (4-7)	42,000	31,273	0.67	B
	Lamar Av. - Park Av.	72'/92'	6U(4-6)	36,000	27,188	0.68	B
	Southern Av. - Central Av.	72'/92'	6U(4-6)	36,000	24,817	0.62	B
Plough Blvd.	Airways Blvd. - Democrat Rd.	90'/230'	4DF(1-4)	60,000	64,928	0.98	E
	Democrat Rd. - Brooks Rd.	90'/230'	4DF(1-4)	60,000	43,951	0.66	B
	Brooks Rd. - Airport Exit	90'/230'	4DF(1-4)	60,000	43,951	0.66	B

APPENDIX C

BUILDING CONSTRUCTIONS TO MEET INDOOR NOISE CRITERIA

This appendix provides specifications that can be incorporated into a building code. Two types of specifications are given: general specifications for building elements that will meet the criteria for hospitals, schools and offices; general element specifications and minimum design specifications for residential buildings. The elements specifications are for buildings designed by architects or engineers with expertise in integration of building components to yield a given performance, while the design specifications are intended to provide the necessary performance without the need for special expertise.

1. Element Specification for Hospitals, Schools and Offices

Table 1 below gives building elements that, when properly used, will provide the required Sound Level Reductions given in the main body of the report. Each construction or set of elements is assigned a letter, and Table 2 shows which constructions apply for the building types as a function of the Day-Night Average Sound Level. Note that "standard" construction is adequate for office buildings up to levels not exceeding L_{dn} 70 dB, and for schools up to levels not exceeding L_{dn} 65dB.

These tables provide the information for only hospitals, schools and office buildings, because design and construction of these buildings will involve architectural and engineering services. The objective is to design buildings so that the required Sound Level Reductions are met, and Tables 1 and 2 provide typical constructions that are adequate. The building code provisions should be written in a way that permits use of alternative designs that are professionally certified to provide the required reductions.

Table 1 Building Constructions that Meet Criteria

Noise Insulation Design	Sound Level Reductions Provided by Construction	Constructions that Meet Standards		
		Wall / Roof	Window Element	
		Min. STC Rating	Min. STC Rating	Max. % of Wall Area
A	50-55	55	50	10
		65	50	20
B	45-50	55	40	10
		55	50	75
C	40-45	50	40	35
		55	45	85
D	35-40	50	35	20
		50	40	85
E	30-35	45	30	20
		45	35	85

Table 2 Noise Insulation Designs by Outdoor Sound Level

Building Type	Day-Night Average Sound Level, dB		
	60-65	65-70	70-75
Hospital	C	B	A
School	Stndrd[1]	E	D
Office	Stndrd	Stndrd	E

[1] Stndrd means standard office building constructions will provide adequate reduction provided windows may be kept closed.

2. Element and Design Specifications for Residential Buildings

The following paragraphs provide the recommended requirements for design and construction of residential buildings within various ranges of L_{dn}.

1. BUILDING REQUIREMENTS FOR A MINIMUM SOUND LEVEL REDUCTION OF 30 dB (Construction in L_{dn} 60 to 65 dB)

1.1 Compliance

Compliance with the following standards shall be deemed to meet the requirements of the various Noise Zones of this Ordinance in which an SLR of 30 dB is specified.

1.2 General

A. Brick veneer, masonry blocks or stucco exterior walls shall be constructed airtight. All joints shall be grouted or caulked airtight.

B. At the penetration of exterior walls by pipes, ducts, or conduits, the space between the wall and pipes, ducts or conduits shall be caulked or filled with mortar.

C. Window and/or through-the-wall ventilation units shall not be used.

D. Through-the-wall/door mail boxes shall not be used.

1.3 Exterior Walls

A. Exterior walls other than as described in this section shall have a laboratory sound transmission class rating of at least STC-40.

B. Masonry walls having a surface wight of at least 30 pounds per square foot do not require a furred (stud) interior wall. At least one surface of concrete block walls shall be plastered or painted with heavy "bridging" paint.

C. Stud walls shall be of at least 4-in. nominal depth and shall be finished on the outside with siding-on-sheathing, stucco, or brick veneer.

1. For siding-on sheathing exterior finishes, the interior surface of the exterior walls shall consist of at least two layers of 1/2-in. gypsum board or one layer of 1/2-in. gypsum board backed with plaster at least 3/4-in. thick, installed on the studs.

2. For stucco or brick veneer exterior finishes, the interior surface of the exterior walls shall be of gypsum board or plaster at least 1/2-in. thick,

installed on the studs.

3. Continuous composition board, plywood, or gypsum board sheathing at least 1/2-in. thick shall cover the exterior side of the wall studs behind wood or metal siding. Asphaltic or wood shake singles are acceptable in lieu of siding.

4. Sheathing panels shall be butted tightly and covered on the exterior with overlapping building paper. The top and bottom edges of the sheathing shall be sealed.

5. Insulation material at least 3-in. thick shall be installed continuously throughout the cavity space behind the exterior sheathing and between wall studs. Insulation shall be glass fiber or mineral wool.

1.4 Windows

A. Windows other than as described in this section shall have a laboratory sound transmission class rating of at least STC-30.

B. Windows shall be double-glazed with glass at least 1/8-in. thick.

C. All operable windows shall be weatherstripped and airtight when closed.

D. Glass of fixed-sash windows shall be sealed in an airtight manner with a non-hardening sealant, or a soft elastomer gasket or glazing tape.

E. The perimeter of window frames shall be sealed airtight to the exterior wall construction with a sealant conforming to one of the following Federal Specifications: TT-S-00227, TT-S-00230, or TT-S-00153.

F. The total area of glass in both windows and doors in sleeping spaces shall not exceed 20% of the floor area.

1.5 Doors

A. Doors, other than as described in this section shall have a laboratory sound transmission class rating of at least STC-30.

B. All exterior side-hinged doors shall be solid-core wood or insulated hollow metal at least 1-3/4 in. thick and shall be fully weatherstripped.

C. Glass in doors shall be sealed in an airtight non-hardening sealant, or in a soft elastomer gasket or glazing tape.

D. Exterior sliding glass doors shall be dual-glazed and hermetically sealed, and shall be weatherstripped with an efficient airtight gasket system. The glass in the sliding doors shall be at least 3/16-in. thick.

E. The perimeter of door frames shall be sealed airtight to the exterior wall construction as described in Section 1.4-E.

1.6 Roofs

A. Combined roof and ceiling construction other than described in this section and Section 1.7 shall have a laboratory sound transmission class rating of at least STC-40.

B. With an attic or rafter space at least 6-in. deep, and with a ceiling below, the roof shall consist of closely butted 1/2-in. composition board, plywood or gypsum board sheathing topped by roofing as required.

C. If the underside of the roof is exposed, or if the attic or rafter spacing is less than 6-in., the roof construction shall have a surface weight of at least 30 pounds per square foot. Rafters, joists or other framing may not be included in the surface weight calculation.

D. Window or dome skylights shall have a laboratory sound transmission class rating of at least STC-30.

1.7 Ceilings

A. Gypsum board or plaster ceilings at least 1/2-in. thick shall be provided where required by Paragraph 1.6-B above. Ceilings shall be substantially airtight, with a minimum number of penetrations.

B. Glass fiber or mineral wool insulation at least 3-in. thick shall be provided above the ceiling between joists.

1.8 Floors

Openings to any crawl spaces below the floor of the lowest occupied rooms shall not exceed 2% of the floor area of the occupied rooms.

1.9 Ventilation

A. A mechanical ventilation system shall be installed that will provide the minimum air circulation and fresh air supply requirements for various uses in occupied rooms without the need to open any windows, doors, or other openings to the exterior.

B. Gravity vent openings in attic shall not exceed code minimum in number and

size.

C. If a fan is used for forced ventilation, the attic inlet and discharge openings shall be fitted with sheet metal transfer ducts of at least 20 gauge steel, which shall be lined with 1-in. thick coated glass fiber, and shall be at least 5-ft. long with one 90° bend.

D. All vent ducts connecting the interior space to the outdoors, excepting domestic range exhaust ducts, shall contain at least a 5-ft. length of internal sound-absorbing duct lining. Each duct shall be provided with a bend in the duct such that there is no direct line of sight through the duct from the venting cross section to the room-opening cross section.

E. Duct lining shall be coated glass fiber duct liner at least 1-in. thick.

F. Domestic range exhaust ducts connecting the interior space to the outdoors shall contain a baffle plate across the exterior termination which allows proper ventilation. The dimensions of the baffle plate should extend at least one diameter beyond the line of sight into the vent duct. The baffle plate shall be of the same material and thickness as the vent duct material.

G. Fireplaces shall be provided with well-fitted dampers.

2. BUILDING REQUIREMENTS FOR A MINIMUM SOUND LEVEL REDUCTION OF 35 dB
(Construction in L_{dn} 65 to 70 dB)

2.1 Compliance

Compliance with the following standards shall be deemed to meet the requirements of the various Noise Zones of this Ordinance in which an SLR of 35 dB is specified.

2.2 General

A. Brick veneer, masonry blocks or stucco exterior walls shall be constructed airtight. All joints shall be grouted or caulked airtight.

B. At the penetration of exterior walls by pipes, ducts or conduits, the space between the wall and pipes, ducts or conduits shall be caulked or filled with mortar.

C. Window and/or through-the-wall ventilation units shall not be used.

D. Operational vented fireplaces shall not be used.

E. All sleeping spaces shall be provided with either a sound-absorbing ceiling or a carpeted floor.

F. Through-the-wall/door mailboxes shall not be used.

2.3 Exterior Walls

A. Exterior walls other than as described below shall have a laboratory sound transmission class rating of at least STC-45.

B. Masonry walls having a surface weight of at least 50 pounds per square foot do not require a furred (stud) interior wall. At least one surface of concrete block walls shall be plastered or painted with heavy "bridging" paint.

C. Stud walls shall be of at least 4-in. nominal depth and shall be finished on the outside with siding-on-sheathing, stucco, or brick veneer.

1. The interior surface of the exterior walls shall be of gypsum board or plaster at least 1/2-in. thick, installed on the studs. The gypsum board or plaster may be fastened rigidly to the studs if the exterior is brick veneer or stucco. If the exterior is siding-on-sheathing, the interior gypsum board or plaster must be fastened resiliently to the studs.

2. Continuous composition board, plywood or gypsum board sheathing shall cover the exterior side of the wall studs behind wood or metal siding. The sheathing and facing shall weigh at least 4 pounds per square foot.

3. Sheathing panels shall be butted tightly and covered on the exterior with overlapping building paper. The top and bottom edges of the sheathing shall be sealed.

4. Insulation material at least 3-in. thick shall be installed continuously throughout the cavity space behind the exterior sheathing and between wall studs. Insulation shall be glass fiber or mineral wool.

2.4 Windows

A. Windows other than as described in this section shall have a laboratory sound transmission class rating of at least STC-35.

B. Windows shall be double-glazed, with glass at least 1/8-in. thick. Panes of glass shall be separated by a minimum 1-in. air space.

C. Double-glazed windows shall employ fixed sash or efficiently weatherstripped operable sash. The sash shall be rigid and weatherstripped with material that is compressed airtight when the window is closed.

D. Glass of fixed-sash windows shall be sealed in an airtight manner with a non-hardening sealant, or a soft elastomer gasket or glazing tape.

E. The perimeter of window frames shall be sealed airtight to the exterior wall construction with a sealant conforming to one of the following Federal specifications: TT-S-00227, TT-S-00230, or TT-S-00153.

F. The total area of glass of both windows and exterior doors in sleeping spaces shall not exceed 20% of the floor area.

2.5 Doors

A. Doors, other than as described in this section shall have a laboratory sound transmission class rating of at least STC-35.

B. Double door construction is required for all door openings to the exterior. Openings fitted with side-hinged doors shall have one solid-core wood or insulated hollow metal core door at least 1-3/4 in. thick separated by an airspace of at least 4 in. from another door, which can be a storm door. Both doors shall be tightly fitted and weatherstripped.

C. The glass of double-glazed sliding doors shall be separated by a minimum 4-in. airspace. Each sliding frame shall be provided with an efficiently airtight weatherstripping material as specified in Section 2.4-C.

D. Glass of all doors shall be at least 3/16-in. thick. Glass of double sliding doors shall not be equal in thickness.

E. The perimeter of door frames shall be sealed airtight to the exterior wall construction as indicated in Section 2.4-E.

F. Glass of doors shall be set and sealed in an airtight non-hardening sealant, or a soft elastomer gasket or glazing tape.

2.6 Roofs

A. Combined roof and ceiling construction other than described in this section and Section 2.7 shall have a laboratory sound transmission class rating of at least STC-45.

B. With an attic or rafter space at least 6-in. deep, and with a ceiling below, the roof shall consist of closely butted 1/2-in. composition board, plywood, or gypsum board sheathing topped by roofing as required.

C. If the underside of the roof is exposed, or if the attic or rafter spacing is less than 6-in., the roof construction shall have a surface weight of at least 50 pounds per square foot. Rafters, joists or other framing may not be included in the surface weight calculation.

D. Window or dome skylights shall have a laboratory sound transmission class rating of at least STC-35.

2.7 Ceilings

A. Gypsum board or plaster ceilings at least 1/2-in. thick shall be provided where required by Paragraph 2.6-B above. Ceilings shall be substantially airtight, with a minimum number of penetrations.

B. Glass fiber or mineral wool insulation at least 3-in. thick shall be provided above the ceiling between joists.

2.8 Floors

The floor of the lowest occupied rooms shall be slab on grade, below grade, or over a fully enclosed basement. All door and window openings in the fully enclosed basement shall be tightly fitted.

2.9 Ventilation

A. A mechanical ventilation system shall be installed that will provide the minimum air circulation and fresh air supply requirements for various uses in occupied rooms without the need to open any windows, doors, or other openings to the exterior.

B. Gravity vent openings in attic shall not exceed code minimum in number and size. The openings shall be fitted with transfer ducts at least 3-ft. in length containing internal sound-absorbing duct lining. Each duct shall have a lined 90° bend in the duct such that there is no direct line of sight from the exterior through the duct into the attic.

C. If a fan is used for forced ventilation, the attic inlet and discharge openings shall be fitted with sheet metal transfer ducts of at least 20 gauge steel, which shall be lined with 1-in. thick coated glass fiber, and shall be at least 5-ft. long with one 90° bend.

D. All vent ducts connecting the interior space to the outdoors, excepting domestic range exhaust ducts, shall contain at least a 10-ft. length of internal sound-absorbing duct lining. Each duct shall be provided with a lined 90° bend in the duct such that there is no direct line of sight through the duct from the venting cross section to the room-opening cross section.

E. Duct lining shall be coated glass fiber duct liner at least 1-in. thick.

F. Domestic range exhaust ducts connecting the interior space to the outdoors shall contain a baffle plate across the exterior termination which allows proper ventilation. The dimensions of the baffle plate should extend at least one diameter beyond the line of sight into the vent duct. The baffle plate shall be of the same material and thickness as the vent duct material.

G. Building heating units with flues or combustion air vents shall be located in a closet or room closed off from the occupied space by doors.

H. Doors between occupied space and mechanical equipment areas shall be solid core wood or 20 gauge steel hollow metal at least 1-3/4 in. thick, and shall be fully weatherstripped.

3. BUILDING REQUIREMENTS FOR A MINIMUM SOUND LEVEL REDUCTION OF 40 dB
(Construction in L_{dn} 70 to 75 dB)

3.1 Compliance

Compliance with the following standards shall be deemed to meet the requirements of the various Noise Zones of this Ordinance in which an SLR of 40 dB is specified.

3.2 General

A. Brick veneer, masonry blocks or stucco exterior walls shall be constructed airtight. All joints shall be grouted or caulked airtight.

B. At the penetration of exterior walls by pipes, ducts or conduits the space between the wall and pipes, ducts or conduits shall be caulked or filled with mortar.

C. Window and/or through-the-wall ventilation units shall not be used.

D. Operational vented fireplaces shall not be used.

E. All sleeping spaces shall be provided with either a sound-absorbing ceiling or a carpeted floor.

F. Through-the-wall/door mailboxes shall not be used.

G. No glass or plastic skylight shall be used.

H. No operable windows or sliding glass doors shall be used.

3.3 Exterior Walls

A. Exterior walls other than as described below shall have a laboratory sound transmission class rating of at least STC-50.

B. Masonry walls having a surface weight of at least 75 pounds per square foot do not require a furred (stud) interior wall. At least one surface of concrete block walls shall be plastered or painted with heavy "bridging" paint.

C. Stud walls shall be of at least 4-in. nominal depth and shall be finished on the outside with siding-on-sheathing, stucco, or brick veneer.

1. For siding-on-sheathing exterior finishes, the interior surface of the exterior walls shall consist of at least two layers of 1/2-in. gypsum board or one layer of 1/2-in. gypsum board backed with plaster at least 3/4-in. thick, installed on the studs.

2. For stucco or brick veneer exterior finishes, the interior surface of the exterior walls shall be of gypsum board or plaster at least 1/2-in. thick, installed on the studs.

3. The interior gypsum board or plaster may be fastened rigidly to the studs if the exterior is brick veneer. If the exterior is stucco or siding-on-sheathing, the interior gypsum board or plaster must be fastened resiliently to the studs.

4. Continuous composition board, plywood or gypsum board sheathing shall cover the exterior side of the wall studs behind wood or metal siding. The sheathing and facing shall weigh at least 4 pounds per square foot.

5. Sheathing panels shall be butted tightly and covered on the exterior with overlapping building paper. The top and bottom edges of the sheathing shall be sealed.

6. Insulation material at least 3-1/2 in. thick shall be installed continuously throughout the cavity space behind the exterior sheathing and between wall studs. Insulation shall be glass fiber or mineral wool.

3.4 Windows

A. Windows other than as described in this section shall have a laboratory sound transmission class rating of at least STC-40.

B. Windows shall be double-glazed and shall employ fixed sash. Glass of double-glazed windows shall be at least 1/8-in. thick. Panes of glass shall be separated by a minimum 3-in. air space and shall not be equal in thickness.

C. Glass of windows shall be sealed in an airtight manner with a nonhardening sealant, or a soft elastomer gasket or glazing tape.

D. The perimeter of window frames shall be sealed airtight to the exterior wall construction with a sealant conforming to one of the following Federal specifications: TT-S-00227, TT-S-00230, or TT-S-00153.

E. The total area of glass of both windows and exterior doors in sleeping spaces shall not exceed 20% of the floor area.

3.5 Doors

A. Doors, other than as described in this section shall have a laboratory sound transmission class rating of at least STC-40.

B. Double door construction is required for all door openings to the exterior. The door shall be side-hinged and shall be solid-core wood or insulated hollow metal, door at least 1-3/4 in. thick, separated by a vestibule of at least 3-ft. in length. Both doors shall be tightly fitted and weatherstripped.

C. The perimeter of door frames shall be sealed airtight to the exterior wall construction as specified in Section 3.4-D.

3.6 Roofs

A. Combined roof and ceiling construction other than described in this section and Section 3.7 shall have a laboratory sound transmission class rating of at least STC-50.

B. With an attic or rafter space at least 6-in. deep, and with a ceiling below, the roof shall consist of closely butted 1/2-in. composition board, plywood, or gypsum board sheathing topped by roofing as required.

C. If the underside of the roof is exposed, or if the attic or rafter spacing is less than 6-in., the roof construction shall have a surface weight of at least 75 pounds per square foot. Rafters, joists or other framing may not be included in the surface weight calculation.

3.7 Ceilings

A. Gypsum board or plaster ceilings at least 1/2-in. thick shall be provided where required by Paragraph 3.6-B above. Ceilings shall be substantially airtight, with a minimum number of penetrations. Ceiling panels shall be mounted on resilient clips or channels. A non-hardening sealant may be used to seal gaps between the ceiling and walls around the ceiling perimeter.

B. Glass fiber or mineral wool insulation at least 3-1/2 in. thick shall be provided above the ceiling between joists.

3.8 Floors

The floors of the lowest occupied rooms shall be slab on grade or below grade.

3.9 Ventilation

A. A mechanical ventilation system shall be installed that will provide the minimum air circulation and fresh air supply requirements for various uses in occupied rooms without the need to open any windows, doors, or other openings to the exterior.

B. Gravity vent openings in attic shall not exceed code minimum in number and size. The openings shall be fitted with transfer ducts at least 6-ft. in length containing internal sound-absorbing duct lining. Each duct shall have a lined 90° bend in the duct such that there is no direct line of sight from the exterior through the duct into the attic.

C. If a fan is used for forced ventilation, the attic inlet and discharge openings shall be fitted with sheet metal transfer ducts of at least 20 gauge steel, which shall be lined with 1-in. thick coated glass fiber, and shall be at least 10-ft. long with one 90° bend.

D. All vent ducts connecting the interior space to the outdoors, excepting domestic range exhaust ducts, shall contain at least a 10-ft. length of internal sound-absorbing duct lining. Each duct shall be provided with a lined 90° bend in the duct such that there is no direct line of sight through the duct from the venting cross section to the room-opening cross section.

E. Duct lining shall be coated glass fiber duct liner at least 1-in. thick.

F. Domestic range exhaust ducts connecting the interior space to the outdoors shall contain a baffle plate across the exterior termination which allows proper ventilation. The dimensions of the baffle plate should extend at least one diameter beyond the line of sight into the vent duct. The baffle plate shall be of the same material and thickness as the vent duct material.

G. Building heating units with flues or combustion air vents shall be located in a closet or room closed off from the occupied space by doors.

H. Doors between occupied space and mechanical equipment areas shall be solid core wood or 20 gauge steel hollow metal at least 1-3/4 in. thick, and shall be fully weatherstripped.